OPERATING AND SERVICE MANUAL

4942A

TRANSMISSION IMPAIRMENT MEASURING SET

HEWLETT hp PACKARD

HP4942A

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HEWLETT hp PACKARD

OPERATING AND SERVICE MANUAL

4942A

TRANSMISSION IMPAIRMENT MEASURING SET

(Including Options 010, 015, 019 & 910)

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 1624A.

For additional important information about serial numbers, see INSTRUMENTS COVERED BY MANUAL in Section I.

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690 E. MIDDLEFIELD ROAD, DRAWER 7021, MOUNTAIN VIEW, CA 94042

MANUAL PART NO. 04942-90002
Microfiche Part No. 04942-90003

Printed: DECEMBER 1976

WARNING

SAFETY

If this instrument is to be energized via an autotransformer for voltage reduction, make sure the common terminal is connected to the earthed pole of the power source.

BEFORE SWITCHING ON THIS INSTRUMENT, the protective earth terminals of this instrument must be connected to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by use of an extension cord (power cable) without a protective conductor (grounding).

Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, etc.) are used for replacement. The use of repaired fuses and the short-circuiting of fuse holders must be avoided.

Whenever it is likely that the protection offered by fuses has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

GROUNDING

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal can make this instrument dangerous. Intentional interruption is prohibited.

HIGH VOLTAGE

Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible and, when inevitable, should be carried out only by a skilled person who is aware of the hazard involved.

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

Adjustments and service described herein are performed with power supplied to the instrument while protective covers are removed. Energy available at many points, if contacted, result in personal injury.

CAUTION

LINE VOLTAGE

BEFORE SWITCHING ON THIS INSTRUMENT, make sure instrument requirements match the voltage of the power source.

GROUNDING

BEFORE SWITCHING ON THIS INSTRUMENT, ensure that all devices connected to this instrument are connected to the protective (earth) ground.

BEFORE SWITCHING ON THIS INSTRUMENT, ensure that the line power (mains) plug is connected to a three-conductor line power outlet that has a protective (earth) ground. (Grounding one conductor of a two-conductor outlet is not sufficient.)

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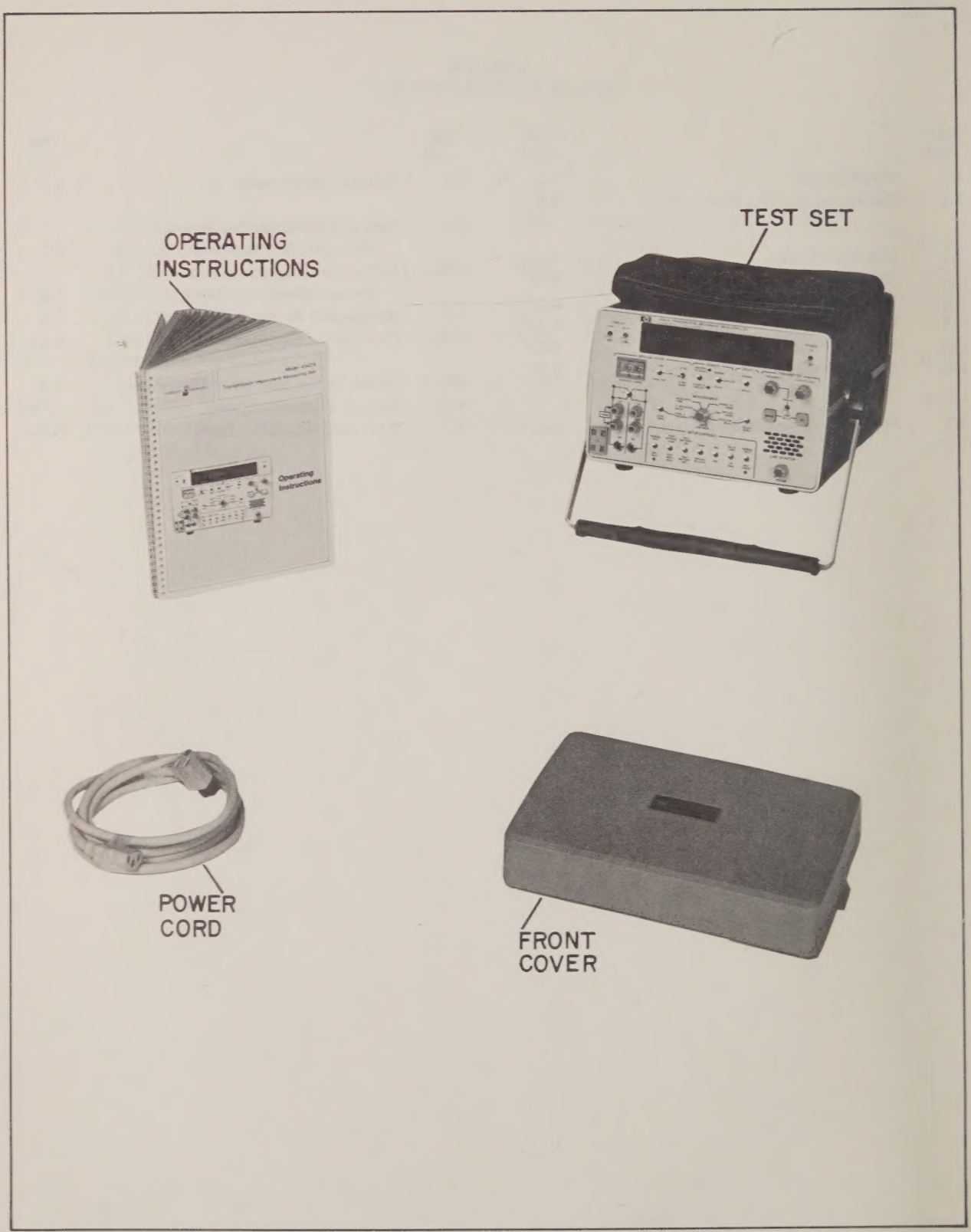


Figure 1-1. Hewlett-Packard Model 4942A Transmission Impairment Measuring Set

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This Operating and Service Manual contains information required to install, operate, test, adjust, and service the Hewlett-Packard Model 4942A Transmission Impairment Measuring Set. Figure 1-1 shows the instrument with its front cover removed.

1-3. Also listed on the title page of this manual is a microfiche part number. This number can be used to order 4 x 6-inch microfilm transparencies of this manual. Each microfiche contains up to 96 photo-duplicates of the manual pages. The microfiche package also includes the latest Manual Changes supplement.

1-4. SPECIFICATIONS

1-5. Instrument specifications are listed in Table 1-1. These specifications are the performance standards or limits against which the instrument is tested.

1-6. INSTRUMENTS COVERED BY MANUAL

1-7. Attached to the instrument is a serial number plate. The serial number is in the form: 0000A-00000. It is in two parts; the first four digits and the letter are the serial prefix and the last five digits are the suffix. The prefix is the same for all identical instruments; it changes only when a change is made to the instrument. The suffix however, is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with the serial number prefix(es) listed under SERIAL NUMBERS on the title page.

1-8. An instrument manufactured after the printing of this manual may have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates the instrument is different from those described in this manual. The manual for this newer instrument is accompanied by a yellow Manual Changes supplement. This supplement contains "change information" that explains how to adapt the manual to the newer instrument.

1-9. In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is identified with the manual print date and part number, both of which appear on the manual title page. Complimentary copies of the supplement are available from Hewlett-Packard.

1-10. For information concerning a serial number prefix that is not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

1-11. DESCRIPTION

1-12. The Hewlett-Packard Model 4942A is a combination test set used by the telephone industry. The unit is used for measuring analog parameters on voice bandwidth data circuits. The parameters measured are (1) loss, (2) C-message noise, (3) noise-with-tone, (4) signal-to-noise ratio, (5) impulse noise, and (6) envelope delay distortion. The 4942A also includes a comprehensive self-check capability.

1-13. The 4942A incorporates master-slave provisions for use on 4-wire circuits. Measurement control for both directions of transmission is at one end of the circuit. At the control end is the master unit. At the remotely controlled end is the slave unit. All test results for both directions are displayed at the master unit. Choice of the direction of test (i.e., master-to-slave or slave-to-master) is by switch selection at the master unit.

1-14. The slave unit requires a simple setup and then may be left unattended. Every Model 4942A may be used as the controlling master or remotely controlled slave. Selection of function is by front panel switch.

1-15. OPTIONS

1-16. Options are modifications or additions to a standard unit that are requested by the customer. Available options are:

a. Option 010. Adds Hewlett-Packard Interface Bus (HP-IB) capability. HP-IB allows calculator or computer control of most measurement functions.

b. Option 015. Adds Model 18055A Transit Case. Provides additional protection for unit during shipment.

c. Option 019. Adds Model 18056A Rack Mounting Adapter. Allows mounting in a 19 inch relay rack.

d. Option 910. Provides an additional set of manuals.

1-17. RECOMMENDED TEST EQUIPMENT

1-18. Equipment required to maintain the Model 4942A is listed in Table 1-2. Other equipment may be substituted if it meets or exceeds the critical specifications listed in the table.

1-19. OPERATING INSTRUCTIONS BOOKLET

1-20. Separate operating instructions are provided in the 4942A Operating Instructions booklet, HP P/N 04942-90001. This manual provides for complete operation of all features except HP-IB. Remote HP-IB operation is covered in the Installation and Operation sections of this manual.

Table 1-1. Specifications (1 of 3)

Transmitter	Receiver
Level and Frequency Frequency Range: 200 Hz to 3950 Hz Resolution: 1 Hz Accuracy: ±0.5 Hz Manual Mode: Continuously adjustable 200 Hz to 3950 Hz Step 100 Hz Mode: 204 Hz to 3904 Hz in 100 Hz increments Level Range: +10 dBm to -40 dBm Resolution: 0.1 dBm Accuracy: ±0.1 dB Frequency Response: ±0.1 dB from 200 Hz to 3904 Hz Harmonic and Spurious Signals Total Harmonic Distortion to 10 kHz: Greater than 50 dB below fundamental Spurious Signals to 10 kHz: Greater than 50 dB below fundamental Background Noise to 10 kHz: Less than -90 dBm	Frequency Range: 200 Hz to 4100 Hz Resolution: 1 Hz Accuracy: ±0.5 Hz Level Range: +10 dBm to -40 dBm Resolution: 0.1 dBm Accuracy: ±0.1 dB at 1 kHz from 0 to -19 dBm; ±0.2 dB over full frequency and level range Detector: Full wave average Bandwidth (3 dB points): Nominal 20 Hz to 10 kHz
Message Circuit Noise Quiet Termination: 600 Ω or 900 Ω	Weighting Filter: C-Message Detector: Quasi RMS Range: +20 dBrnC to +90 dBrnC Resolution: 1 dBrnC Accuracy: ±1 dB
Noise-With-Tone Frequency: 1004 Hz fixed Level Range: +10 dBm to -40 dBm Resolution: 1 dBm Background Noise, Harmonics and Spurious Signals: Refer to LEVEL AND FREQUENCY	Notch Filter: Greater than 50 dB rejection from 995 Hz to 1025 Hz Other Specifications: Refer to MESSAGE CIRCUIT NOISE
Channel Signal To Noise Ratio* Frequency: 1004 Hz fixed Level Range: +10 dBm to -40 dBm Resolution: 1 dBm Background Noise, Harmonics and Spurious Signals: Refer to LEVEL AND FREQUENCY	Weighting Filter: C-Message Detector: Quasi RMS Range: 10 dB to greater than 50 dB Resolution: 1 dB Accuracy: ±1 dBm

*Signal Plus Noise to Noise Ratio

Table 1-1. Specifications (2 of 3)

Transmitter	Receiver
Impulse Noise Frequency: 1004 Hz fixed Level Range: +10 dBm to -40 dBm Resolution: 1 dBm Background Noise, Harmonics and Spurious Signals: Refer to LEVEL AND FREQUENCY	Received Tone Level: 0 dBm to -40 dBm Notch Filter: Greater than 50 dB rejection from 995 Hz to 1025 Hz Impulse Noise Threshold Range: 30 dBrnC to 109 dBrnC Impulse Noise Threshold Accuracy: ±1 dB Impulse Noise Count Range: 0 to 9,999 Count Rate: 7 counts per second max. ±5% Count Interval: 5 minute, 15 minute, or non-stop Digital Timer: Displays minutes remaining for timed intervals; displays minutes elapsed for non-stop counting. Loss of Holding Tone Indication: Minus sign appears in left hand display when holding tone drops below - 40 dBm +0 dB -5 dB, for greater than 1 second.
Envelope Delay Frequency Range: 200 Hz to 3904 Hz Other Frequency Specifications: Refer to LEVEL AND FREQUENCY Modulation Frequency: 83 1/3 Hz Level Range: +10 dBm to -40 dBm Other Level Specifications: Refer to LEVEL AND FREQUENCY Harmonic and Spurious Signals to 10 kHz: 83 1/3 Hz and 3($f_{carrier}$)+83 1/3 Hz greater than 52 dB below main signal power. All other signals greater than 46 dB below main signal power. Background Noise to 10 kHz: Less than -90 dBm	Frequency Range: 300 Hz to 3904 Hz Other Frequency Specifications: Refer to LEVEL AND FREQUENCY Level Range: +10 dBm to -40 dBm Carrier Level Accuracy ±0.25 dB Other Level Specfications see LEVEL AND FREQUENCY Delay Range: -3,000 µs to 9,000 µs Resolution: 1 µs Accuracy (back to back): ±10 µs from 600 Hz to 3904 Hz; ±30 µs from 300 Hz to 600 Hz Minimum Signal to Noise Ratio (for stated accuracy): 20 dB, 3 kHz flat weighting
Line Loop Back Frequency Range: 204 Hz to 3904 Hz Retransmit Level Range: 0 dBm to -40 dBm Resolution: 0.1 dBm Accuracy: ±1 dB	
Miscellaneous Longitudinal Balance: 60 dB to 6 kHz, decreasing 6 dB per octave above 6 kHz Impedances: 600 Ω and 900 Ω Return Loss: Greater than 40 dB SF Skip: 2450 Hz to 2750 Hz	Longitudinal Balance: 60 dB to 6 kHz, decreasing 6 dB per octave above 6 kHz Terminating Impedances: 600 Ω and 900 Ω Bridging Impedance: Greater than 45 K Ω Bridging Loss: Less than 0.3 dB at 1 kHz Return Loss: Greater than 40 dB High Frequency Protection: Greater than 60 dB attenuation above 500 kHz

Table 1-1. Specifications (3 of 3)

Master/Slave Control

MASTER unit controls SLAVE unit measurement selection and SLAVE unit transmitter frequency tuning. All data measured by SLAVE unit is sent to MASTER unit for display. Control signals and data are sent as 360 baud FSK signals on the pair not being tested of the four wire circuit under test.

Operating Mode Selection: MASTER operation or SLAVE operation selectable by front panel switch.

Direction of Test: MASTER TO SLAVE or SLAVE TO MASTER selectable by MASTER unit front panel switch.

Minimum Signal to Noise Ratio for MASTER/SLAVE Operation: 16 dB

Hewlett-Packard Interface Bus (HP-IB) Option 010

HP-IB provides bi-directional digital input-output lines for program control ("listener") and output of measurement data ("talker").

Programmable Functions: Measurement Selection, Transmitter Frequency, Display modes, Delay and Level Zero Commands, IMPULSE NOISE Start/Reset/Stop Commands and Count Interval, Output Modes, MASTER/SLAVE Controls.

General

Test Jacks: 310 jacks and 5-way binding posts for both transmitter and receiver.
DC blocking (with no holding): 200 volts

Power Requirements: 117 Vac ±10%, 50/60 Hz, 45 watts

Operating Temperature: 0°C to 50°C (32°F to 131°F)

Storage Temperature: -40°C to 75°C (-40°F to 167°F)

Weight: Net 11.8 kg (26 lb.); shipping 20.5 kg (45 lb.)

Dimensions:

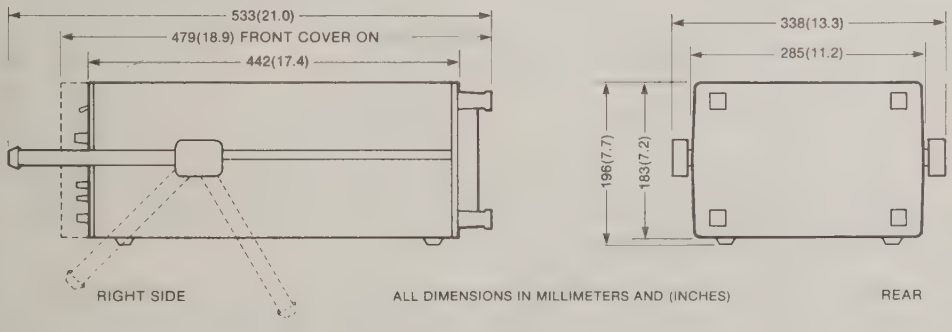


Table 1-2. Recommended Test Equipment

INSTRUMENT	CRITICAL SPECIFICATIONS	RECOMMENDED MODEL	USE*
AC Calibrator[1]	Amplitude Accuracy: ±0.1% Impedance: 600 ohms	HP 745A	P,A,T
AC/DC Digital Voltmeter[2]	AC Measurement: True RMS Accuracy: ±0.01%	HP 3480A/B/C/D	P,A,T
DC Milliammeter	Range: 0-40 mA	HP 428A/B	P,A,T
DC Power Supply	Voltage: 0-> 50 Vdc	HP 6217A	P,A,T
Frequency Counter	Frequency Range: 50 Hz-10 MHz	HP 5381A	P,A,T
Oscilloscope[3]	Bandwidth: >500 kHz Mode: Capability of A vs. B	HP 1200A/B	A,T
Spectrum Analyzer[4]	Frequency Range: 50 Hz-50 kHz Bandwidth (min.): 50 Hz	HP 3580A/3581A	P,A,T
Variable AC Transformer	Voltage Output: 90-130 Vac Current Capability: 2A		A,T
Resistor	600 ohm, 0.5%, 1/4W	HP P/N 0698-6261	P,A,T
Potentiometer	2000 ohm, 2W	HP P/N 2100-2729	A,T
Extender Board	44 pin	HP P/N 04942-60036	A,T
Extender Board	86 pin	HP P/N 04942-60035	T
HP-IB Bus System Analyzer[5]	Capable of exercising another talker, listener, or controller.	HP 59401A	T

*P = Performance Test, A = Adjustments, T = Troubleshooting.

NOTES: [1]If AC Calibrator is not available, it is possible to use an audio oscillator and AC DVM. The oscillator must be capable of producing frequencies between 150 Hz and 5 kHz, at an amplitude of 2.5 VRMS into 600 ohms.

[2]The AC DVM needs true RMS capability only for noise-related measurements. For all other measurements, an average-reading AC DVM is sufficient.

[3]If oscilloscope with A vs. B capability is not available, it is possible to use an oscilloscope with EXT HORIZONTAL input, with as much sensitivity as possible. Do not use any amplifier which might distort the phase of the incoming signal.

[4]If spectrum analyzer is not available, it is possible to use a wave analyzer, or other frequency-selective voltmeter. A distortion analyzer measuring total harmonic distortion is not usable.

[5]Used only for HP-IB service.

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section contains information on unpacking and incoming inspection, power requirements, mounting, checkout, and packing and shipping for the Model 4942A Transmission Impairment Measuring Set.

2-3. UNPACKING AND INSPECTION

2-4. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the unit has been checked mechanically and electrically. Procedures for checking electrical performance are given in paragraph 2-12. If the contents are incomplete, if there is mechanical damage or defect, or if the unit does not pass the electrical performance test, notify the nearest Hewlett-Packard office (listed in the back of this manual). If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for carrier's inspection. The HP office will arrange for repair or replacement without waiting for claim settlement.

2-5. POWER REQUIREMENTS

2-6. The test set operates on standard commercial power of between 105 and 129 volts, at 50 or 60 Hz.

2-7. POWER CORD

2-8. To protect operating personnel, the test set panel and chassis must be grounded. This test set is equipped with a detachable three-conductor power cable (HP P/N 8120-2220) which, when connected to a properly grounded power receptacle, grounds the unit.

WARNING

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal can make this instrument dangerous. Intentional interruption is prohibited.

2-9. MOUNTING

2-10. The standard 4942A is provided with plastic feet on the bottom and back. This allows placement on any flat surface. If it is desired to rack mount the test set, then Option 019 may be ordered at the time of purchase (includes Model 18056A Rack Mount Adapter). To add rack mount capability after purchase, then Model 18056A may be ordered separately.

2-11. The test set is air cooled with ventilation holes on the sides and bottom. The power supply, located at the back of the unit, has cooling fins exposed. These fins provide convection cooling for the power supply circuitry.

CAUTION

The test set must have free air flow around all surfaces to prevent overheating. Do not block ventilation holes, or place the test set on top of heat generating equipment.

2-12. BEFORE-USE CHECKOUT

2-13. To determine that the test set is electrically operational, perform the Self Check procedures as described in the Operation section of this manual. The self check procedures will determine if the test set is operating properly.

2-14. SHIPPING INSTRUCTIONS

2-15. USING ORIGINAL PACKAGING

2-16. The same container and packing material used in factory packaging can be obtained through Hewlett-Packard Sales and Service Offices listed at the back of this manual. If the test set is being

returned to Hewlett-Packard for servicing, attach a tag indicating the type of service or repair required, return address, model number, option numbers, and full serial number. Also mark the container FRAGILE to assure careful handling. In any correspondence, refer to the test set by model number, option numbers, and full serial number.

2-17. USING OTHER PACKAGING

2-18. The following general instructions should be used for repackaging with commercially available materials:

a. Wrap the test set in heavy paper or plastic. If shipping to a Hewlett-Packard Sales and Service Office, attach a tag indicating the type of service required, return address, model number, option numbers, and full serial number.

b. Use a strong shipping container. A double-wall carton made of 275 pound test material is adequate.

c. Use enough shock-absorbing material (3- to 4-inch layer) around all sides of the test set to provide firm cushioning and prevent movement inside the container.

d. Seal the shipping container securely and mark it FRAGILE to assure careful handling.

e. In any correspondence, refer to the test set by model number, option numbers, and full serial number.

2-19. HP-IB INSTALLATION

2-20. Figure 2-1 shows the standard interface cables used for hookup between the 4942A and the calculator. The 10631A/B/C cables are available in three lengths to suit user requirements. The connectors at either end of the cable are identical. The plugs will mate with the rear panel connector on the 4942A. The receptacle on the back of the cable connector will receive another cable plug.

2-21. A Bus Interface Kit is needed to use a Hewlett-Packard calculator as the HP-IB controller. For example, the kit for the HP 9830A Calculator (Model 59405A/Option 030) includes the Bus Interface I/O Card, the 11272B Extended I/O ROM, a 4 meter (13.2 ft) HP-IB Cable, and a User's Guide.

2-22. MAXIMUM CABLE LENGTH

2-23. As many as 15 instruments can be connected in parallel. (Be sure to count the calculator when counting the number of devices in the system). However, observe the following rules:

a. The total cable length for the system must be less than or equal to 20 meters (65 ft.).

b. The total cable length for the system must be less than or equal to 2 meters (6 ft.) times the total number of devices connected to the bus.

For instance, a system with one calculator and one 4942A would allow 4 meters (12 ft.) of cable.

2-24. ADDRESS SELECTION

2-25. The HP-IB address selector switch is located on the HP-IB PC board assembly A21. The switch is preset at the factory for:

	ASCII	Binary
Talk Address	J	1001010
Listen Address	*	0101010

MSB LSB

The last five bits in the binary code are switch selectable. The first two digits (most significant) are "hard wired" into the HP-IB circuitry.

2-26. To change the address of the 4942A, follow this procedure:

a. Turn off the power switch and unplug the power cord.

b. Release the top cover by turning the four top screws 1/4 turn counterclockwise.

c. Remove the top cover.

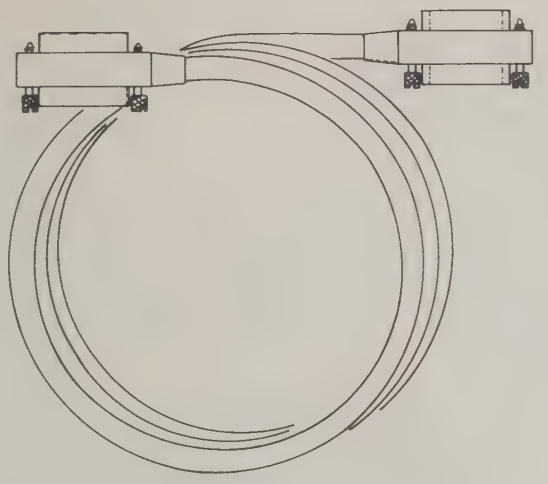
d. Partially pull out the A21 board (no need to pull it all the way out and disconnect cable).

e. The address selector switch is seven SPST switches contained in a dual-in-line (DIP) package. See Figure 2-2. The figure shows the switch with the factory preset values.

f. The switch settings may now be changed with a pointed instrument (like a pencil or pen).

NOTE

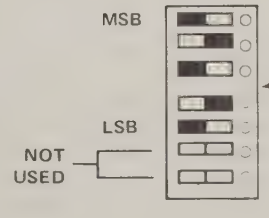
Do not set all address switches to the "1" position. This code is reserved for special use.



CABLE PART NO.	LENGTH
10631A	1m (3.3 ft)
10631B	2m (6.6 ft)
10631C	4m (13.2 ft)

Figure 2-1. Interface Bus Cables

MSB				LSB	ASCII LISTEN ADDRESS	ASCII TALK ADDRESS
0	0	0	0	0	SP	@
0	0	0	0	1	!	A
0	0	0	1	0	"	B
0	0	0	1	1	#	C
0	0	1	0	0	$	D
0	0	1	0	1	%	E
0	0	1	1	0	&	F
0	0	1	1	1	'	G
0	1	0	0	0	(	H
0	1	0	0	1	)	I
0	1	0	1	0	*	J
0	1	0	1	1	+	K
0	1	1	0	0	,	L
0	1	1	0	1	–	M
0	1	1	1	0	.	N
0	1	1	1	1	/	O
1	0	0	0	0	0	P
1	0	0	0	1	1	Q
1	0	0	1	0	2	R
1	0	0	1	1	3	S
1	0	1	0	0	4	T
1	0	1	0	1	5	U
1	0	1	1	0	6	V
1	0	1	1	1	7	W
1	1	0	0	0	8	X
1	1	0	0	1	9	Y
1	1	0	1	0	:	Z
1	1	0	1	1	;	[
1	1	1	0	0	<	\
1	1	1	0	1	=	]
1	1	1	1	0	>	^



FACTORY PRESET VALUES:

TALK = J = 10 01010

LISTEN = * = 01 01010

Figure 2-2. HP-IB Address Selection

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SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section contains information on front and rear panel features, self check procedures, condition codes (H-codes), and operation using the remote HP-IB interface. Also covered are the principles of operation for all measurements, plus master-slave operation.

3-3. If any of the self check procedures fail acceptable limits as specified in the checks, then adjustment or repair may be necessary.

3-4. Operating instructions for the Model 4942A are covered in this manual only to the extent needed for service. For specific operating procedures, see the 4942A Operating Instructions booklet, HP P/N 04942-90001.

3-5. SELF CHECK

3-6. The self check procedures should be performed periodically by the instrument user to verify performance. The self check procedures should be used for incoming inspection to verify a customer complaint and to determine if any other problems exist. The self check procedures should also be performed prior to the performance checks. The performance checks then verify that the instrument meets published specifications. Failure of the instrument to pass any self check procedure indicates a malfunction that can possibly affect other measurements.

3-7. CONDITION CODES

3-8. Under certain conditions, the 4942A will abort or fail to achieve its normal display. The display will then show a "condition code" or "error code". All these codes contain an "H" prefix followed by two numerals (such as H-08). The self check procedures in Figure 3-2 contain a list of the codes possible when self check fails. Table 3-1 lists the codes possible during normal operation.

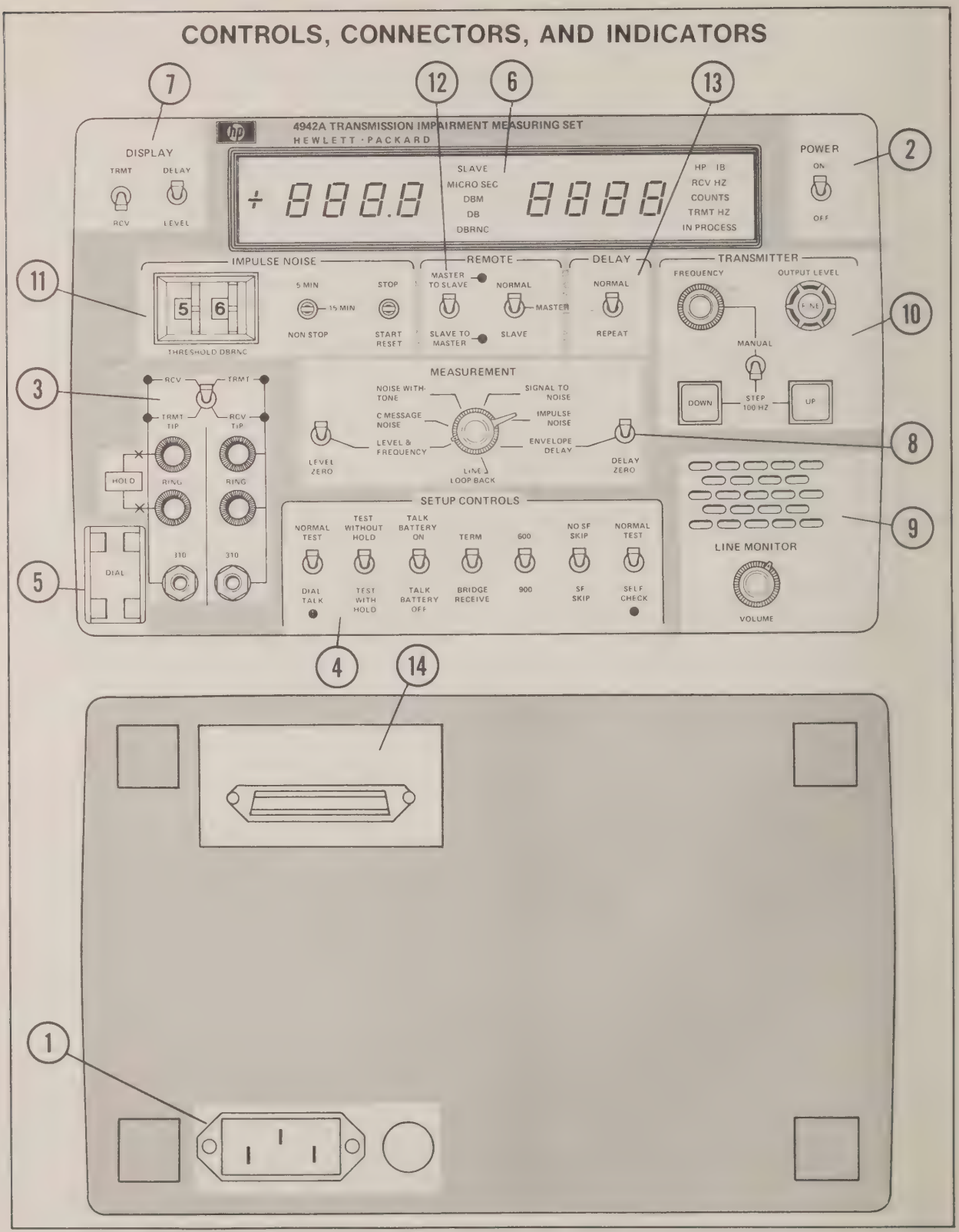


Figure 3-1. Front and Rear Panel Controls, Connectors, and Indicators (1 of 5)

CONTROLS, CONNECTORS, AND INDICATORS

(1) **Power Cord Receptacle and Fuse.** 117V ac (±10%) 60 Hz power is applied to test set through male power cord receptacle, located on rear of test set. AC line fusing is provided by a 0.75 Amp (SB) fuse located in the fuse holder next to the power cord receptacle. WARNING: ALWAYS CONNECT POWER CORD TO A PROPERLY GROUNDED 3-WIRE POWER OUTLET.

(2) **POWER Switch.** Switches test set ac operating power ON and OFF.

(3) **RCV-TRMT Jacks.** A two position toggle switch is used to reverse connections of the left and right jack fields. When switch is in up position, the left jacks are connected for RCV (receive) and the right jacks for TRMT (transmit). When switch is down, connections are reversed. Dot lamps indicate functions of respective jack fields. Connections can be made either to the 310 jacks, or to the TIP and RING binding posts, which are multipled. The left jack field should always be used for 2-wire wet transmit and receive connections; the right field for 2-wire dry connections. Both left and right jack fields are used for 4-wire connections.

(4) **SETUP CONTROLS.**

NORMAL TEST – DIAL/TALK Switch. In NORMAL TEST position the selected TRMT jack is connected to the test set's transmitter circuitry, but not to the DIAL connectors. In DIAL/TALK position the TRMT jack is connected to the DIAL connectors, but not to the transmitter circuitry.

TEST WITHOUT HOLD – TEST WITH HOLD Switch. In TEST WITHOUT HOLD position the test set holding circuit is disconnected from the RCV-TRMT jacks. In TEST WITH HOLD position the holding circuit is connected across TIP and RING of the left jack field to hold 2-wire wet (DDD) circuits while testing.

TALK BATTERY ON – TALK BATTERY OFF Switch. In TALK BATTERY ON position the test set provides the necessary talk battery to the DIAL terminals to talk on dry circuits with a lineman's handset. In TALK BATTERY OFF position, talk battery must be supplied by the circuit under test if talking is desired.

TERM – BRIDGE RECEIVE Switch. In TERM position the test set provides a termination on both the RCV AND TRMT circuits. The desired terminating impedance must be selected with the 600-900 switch. In BRIDGE-RECEIVE position the receiving test set is bridged across the circuit under test, which must be terminated with other equipment. NOTE: When using BRIDGE RECEIVE it is still necessary to select the proper impedance of the line under test with the 600-900 switch in order to normalize the measurements.

600-900 Switch. The 600Ω or 900Ω termination must be selected to match the characteristic impedance of the line under test. When operating in TERM mode, both the TRMT and RCV circuits are terminated in the selected impedance. When operating in BRIDGE RECEIVE mode, the TRMT circuit is still terminated in the selected impedance and the RCV circuit is bridged by more than 45 kΩ. The selection also normalizes level measurements for the respective impedances.

NO SF SKIP – SF SKIP Switch. In NO SF SKIP position the test set will transmit all selected frequencies. In SF SKIP position the test set will not transmit any frequencies between 2450 Hz and 2750 Hz. This feature prevents the circuit under test from being disconnected by SF signaling units on the dial-up network.

NORMAL TEST – SELF CHECK Switch. In NORMAL TEST position the test set performs normal testing. In SELF CHECK position proper operation of the test set can be verified by performing the procedures given in the SELF CHECK section of this manual.

Figure 3-1. Front and Rear Panel Controls, Connectors, and Indicators (2 of 5)

CONTROLS, CONNECTORS, AND INDICATORS

(5) **DIAL Connectors.** Provides connections for a lineman's handset (butt-in). The terminals are connected to the selected TRMT jack when the DIAL/TALK mode is selected.

(6) **Digital Displays.** Two digital displays provide quantitative information and measurement units for all measurements. Ranging is automatic, and polarity and decimal points are automatically displayed when appropriate. Up to two parameters can be displayed simultaneously. The displays also indicate underrange and overrange conditions. Display of only a (–) sign indicates underrange. Display of only a (+) sign indicates overrange.

(7) **DISPLAY Switches.**

TRMT – RCV Switch. Selects either the transmitted or received information to be displayed.

LEVEL – DELAY Switch. Used in ENVELOPE DELAY measurements to display either level (DBM) or delay (MICRO SEC) information.

(8) **MEASUREMENT Switch.** Programs the test set to perform the selected measurement. For a detailed procedure describing the use of each MEASUREMENT switch position, see the appropriate section of this manual.

LEVEL ZERO Switch. Used in LEVEL & FREQUENCY mode to establish a zero dB reference. All subsequent measurements will be made in dB relative to this reference. If this switch is not operated, measurements will be in absolute dBm. NOTE: If LEVEL ZERO switch has been actuated and it is desired to make an absolute dBm measurement, momentarily rotate MEASUREMENT switch to another position, then back to LEVEL & FREQUENCY again.

DELAY ZERO Switch. Used in ENVELOPE DELAY mode to establish a zero microsecond delay reference. All subsequent envelope delay measurements will be relative to this reference.

(9) **LINE MONITOR Speaker and VOLUME Control.** Permits listening to the circuit under test, or the test set transmitter. The DISPLAY TRMT – RCV switch determines whether the transmitted or received signal is being monitored. The speaker output is an amplified reproduction of signals on the circuit (except in C-MESSAGE NOISE mode, which produces a C-weighted output). Speaker output can be controlled with the VOLUME control.

(10) **TRANSMITTER Controls.**

MANUAL – STEP 100 HZ Switch. In MANUAL position frequency is continuously variable from 200 Hz to 3950 Hz by adjusting the FREQUENCY control. In STEP 100 HZ position frequency is manually stepped in 100 HZ increments from 204 Hz to 3904 Hz by depressing the UP and DOWN pushbuttons.

OUTPUT LEVEL Control. Varies transmitter output level continuously from –39 dBm to +10 dBm. Output level is displayed on left display.

Figure 3-1. Front and Rear Panel Controls, Connectors, and Indicators (3 of 5)

CONTROLS, CONNECTORS, AND INDICATORS

(11) **IMPULSE NOISE Controls.**

THRESHOLD DBRNC Switches. Sets the desired threshold above which impulse noise peaks will be totalized on the display. The threshold is adjustable from 30 to 109 dBrnC.

5 MIN – 15 MIN – NONSTOP Count Time Switch. Selects length of time for which impulse noise is counted. Counting is stopped automatically when either the 5 MIN or 15 MIN positions are selected. Counting must be stopped manually with the STOP – START/RESET switch when the NONSTOP position is selected.

STOP – START/RESET Switch. Impulse noise counting is stopped and total is held on display when switch is momentarily held in STOP position. All previous counts are reset to zero on display and new counting interval is initiated when switch is momentarily held in START/RESET position.

(12) **REMOTE Switches.**

MASTER TO SLAVE – SLAVE TO MASTER Switch. Selects transmission path to be tested. Selecting the MASTER TO SLAVE position will cause the circuit connected to the TRMT jack at the MASTER unit to be tested. Selecting the SLAVE TO MASTER position will cause the circuit connected to the RCV jack at the MASTER unit to be tested. The dot lamp associated with the respective position indicates that the MASTER unit has achieved control of the SLAVE unit. The lamp should light within 10 seconds after the NORMAL – MASTER – SLAVE switches are properly positioned on both the MASTER and SLAVE units.

NORMAL – MASTER – SLAVE Switch. In NORMAL position all controls are under manual control. The test set can be operated manually with other compatible test sets. In MASTER position the unit is in remote control of the SLAVE unit for all MEASUREMENT functions. In SLAVE position the unit is remotely controlled by the MASTER unit for all MEASUREMENT functions.

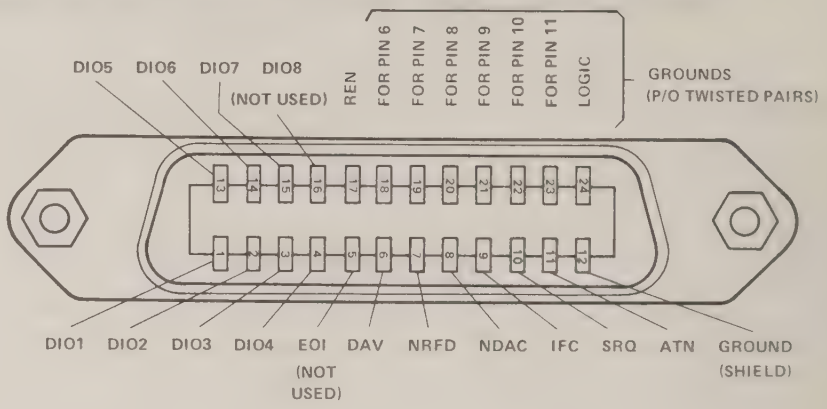
(13) **DELAY Switch.** Used in ENVELOPE DELAY mode to determine whether the test set is to measure envelope delay (NORM), or to retransmit the envelope delay signal from the far-end of the circuit (REPEAT). This control is not used during MASTER-SLAVE operation.

(14) **HP-IB Connector (Option 010).** Connections to Hewlett-Packard Interface Bus for controlling the Model 4942A with a calculator or computer. *Key 14 continued next page.*

Figure 3-1. Front and Rear Panel Controls, Connectors, and Indicators (4 of 5)

CONTROLS, CONNECTORS, AND INDICATORS

(14) HP-IB Connector (Continued)



LOGIC LEVELS

HP-IB logic levels are low true and TTL compatible (LO = 0.0 to +0.4 Vdc, HI = +2.5 to +5.0 Vdc).

Example: SRQ is LO active.
NRFD is HI active.

Input Signals:

Each input line is terminated with 3000 ohms to +5V and 6200 ohms to ground (one TTL load).

Output Signals:

Each output can drive 15 HP-IB loads. The output is an open-collector driver capable of sinking 48 mA at 0.4V output.

SIGNALS

NRFD

Ready For Data. Indicates 4942A will accept data when NRFD is HIGH.

NDAC

Data Accepted. Indicates 4942A has accepted data. Returns to LOW when 4942A is finished processing data.

DAV

Data Valid. Indicates valid output data is available from 4942A if addressed to talk. Input data is available if 4942A is addressed to listen and ATN is HIGH. Address is valid if ATN is LOW.

ATN

Attention. A LOW state indicates commands are present on the DIO lines. A HIGH state indicates data is present on the DIO lines.

DIO1 thru DIO8

Data Input-Output lines. Message bytes are carried on the DIO signal lines in a bit-parallel byte serial form, asynchronously and generally in a bidirectional manner. DIO8 not used in 4942A.

REN

Remote Enable. Used by the controller to cause the 4942A to be placed in the remote mode.

SRQ

Service Request. Indicates the 4942A wants the attention of the controller.

IFC

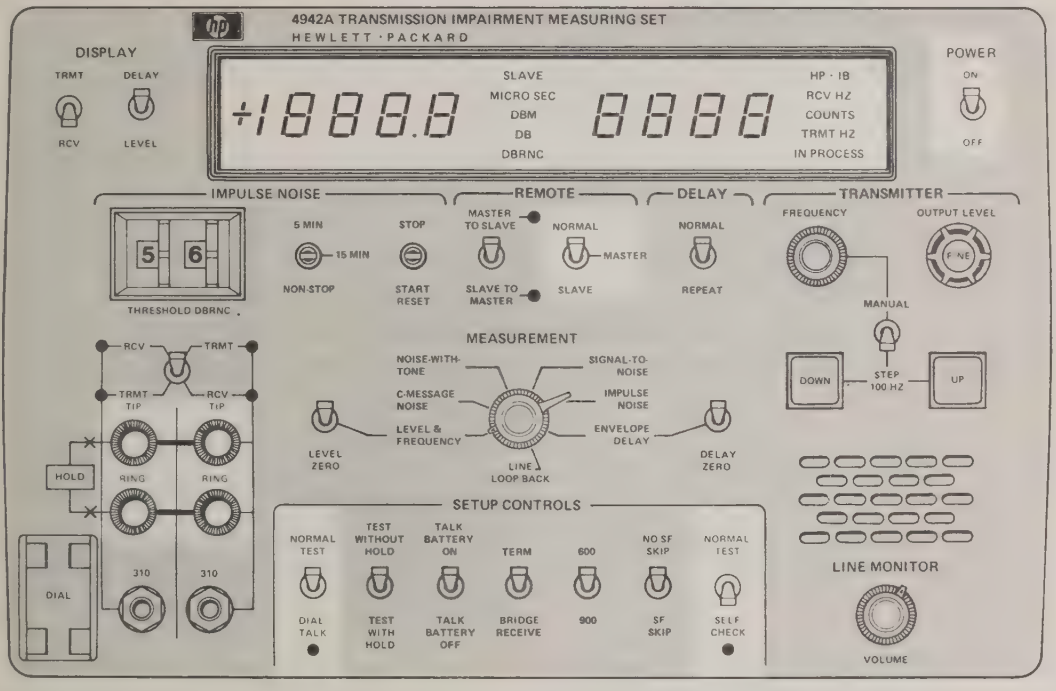
Interface Clear. Used by the controller to terminate all activity on the bus.

EOI

Not used in 4942A.

Figure 3-1. Front and Rear Panel Controls, Connectors, and Indicators (5 of 5)

SELF CHECK PROCEDURES



NOTE

The SELF CHECK routine automatically makes an operational check of the test set, including its ability to operate in MASTER and SLAVE modes. The test set will automatically step through the SELF CHECK routine and should produce indications at each step as indicated below. At the end of the SELF CHECK routine, the display will indicate PASS if all checks are within specifications. If any steps fail to pass, the display will indicate failure codes at the end of the routine for those steps that fail to pass. A list of SELF CHECK failure codes, and their meanings are given at the end of this procedure.

The SELF CHECK procedure should be performed periodically to verify performance of the test set. SELF CHECK is recommended before transporting the test set to a remote testing site; or whenever there is any doubt about transmission measurement results.

1. PRELIMINARY SETUP
   a. Disconnect test set from on-line testing.
   b. Switch POWER ON.
   c. Loop TRMT jack to RCV jack. Operate RCV/TRMT jack field switch and observe that corresponding dot lamps light.
   d. Set all SETUP CONTROLS Switches to "up" positions.
   e. Set REMOTE Switch to NORMAL or MASTER.
   f. Set NORMAL TEST – SELF CHECK Switch to SELF CHECK.

Figure 3-2. Self Check Procedures (1 of 3)

SELF CHECK PROCEDURES

2. STEP 1: DISPLAY AND ANNUNCIATOR CHECKS

   a. Observe that left display indicates + 888.8 and that right display indicates 8888. Observe that all numerical segments are present and evenly illuminated.

   b. Observe that all display annunciators are on and evenly illuminated.

   c. Observe that MASTER TO SLAVE and SLAVE TO MASTER dot lights are on.

NOTE

It is not necessary to observe the following test routine unless it is desired to analyze a specific problem with the test set. SELF CHECK status will be displayed at the end of the routine.

3. STEPS 2-4: LEVEL & FREQUENCY CHECKS

   a. Left display should indicate +0.0 DBM (±0.3 dBm). Right display should indicate 204 RCV HZ (±2 Hz).

   b. Left display should indicate +0.0 DBM (±0.3 dBm). Right display should indicate 1004 RCV HZ (±2 Hz).

   c. Left display should indicate +0.0 DBM (±0.3 dBm). Right display should indicate 3904 RCV HZ (±2 Hz).

4. STEPS 5-7: C-MESSAGE FILTER CHECKS

   a. Left display should indicate -16.0 DBM (±1.0 dBm). Right display should indicate 304 RCV HZ (±2 Hz).

   b. Left display should indicate +0.0 DBM (±0.3 dBm). Right display should indicate 1004 RCV HZ (±2 Hz).

   c. Left display should indicate -2.5 DBM (±1.0 dBm). Right display should indicate 3004 RCV HZ (±2 Hz).

5. STEP 8: NOISE-WITH-TONE NOTCH CHECK

   a. Left display should indicate less than -50 DBM (algebraically). Right display should indicate 1004 RCV HZ (±2 Hz).

6. STEP 9: IMPULSE NOISE CHECK

   a. Right display should indicate 70 COUNTS (±4 Counts).

7. STEP 10: ENVELOPE DELAY CHECK

   a. Left display should reset to 0 MICROSECONDS, then indicate 3000 MICROSECONDS (±10μS). Right display should indicate 1804 RCV HZ (±2 Hz).

8. STEP 11: SELF CHECK STATUS DISPLAY

   a. If all SELF CHECK tests are within specifications the display will indicate PASS until the NORMAL TEST – SELF CHECK Switch is returned to the NORMAL TEST position. The test set has passed all of the above visible tests, in addition to ENVELOPE DELAY response time and a complete check of the modem used for MASTER - SLAVE operation.

   b. If the test set fails to pass any of the above tests, failure codes will be displayed indicating the tests that have failed. These codes will be displayed sequentially until the NORMAL TEST – SELF CHECK Switch is returned to the NORMAL TEST position. Following are interpretations of the SELF CHECK failure codes that can be displayed:

Figure 3-2. Self Check Procedures (2 of 3)

SELF CHECK PROCEDURES

CODE	MESSAGE
H20	Level out of tolerance at 204 Hz (STEP 2)
H21	Level out of tolerance at 1004 Hz (STEP 3)
H22	Level out of tolerance at 3904 Hz (STEP 4)
H30	C-Message filter out of tolerance at 304 Hz (STEP 5)
H31	C-Message filter out of tolerance at 1004 Hz (STEP 6)
H32	C-Message filter out of tolerance at 3004 Hz (STEP 7)
H33	Noise-With-Tone notch out of tolerance (STEP 8)
H34	Impulse Noise counts out of tolerance (STEP 9)
H40	Frequency out of tolerance at 204 Hz, 1004 Hz, or 3904 Hz (STEPS 2-4)
H70	Envelope Delay response time out of tolerance (STEP 10)
H71	Envelope Delay accuracy out of tolerance (STEP 10)
H80, H81, H82, H83	Test set modem does not pass SELF CHECK (NOTE: Failure of the modem affects only MASTER – SLAVE operation. Normal operation is not affected).

9. SELF CHECK – MODEM ONLY.

If a quick SELF CHECK of only the modem is desired, the following procedure can be used:

a. Perform PRELIMINARY SETUP procedures (a) through (e).

b. Hold DELAY ZERO Switch in "down" position while setting NORMAL TEST – SELF CHECK Switch to SELF CHECK. Release DELAY ZERO Switch.

c. If modem passes SELF CHECK, display will immediately indicate PASS. Refer to failure codes, above, if failure code is displayed.

Figure 3-2. Self Check Procedures (3 of 3)

Table 3-1. Condition Codes (1 of 2)

CONDITION CODE	MESSAGE	PROBABLE CAUSES	RECOMMENDED ACTIONS
H-00	Front panel controls changed while MASTER attempting to achieve control over SLAVE.	1. Operator error.	1. Do not touch controls until dot light illuminates.
H-01	No data carrier received from SLAVE.	1. SLAVE OUTPUT LEVEL set too low	1. Check SLAVE OUTPUT LEVEL.
		2. Excessive circuit loss.	2. Check that MASTER receives at least –40 dBm.
		3. 4942A problem.	3. Perform SELF CHECK on MASTER and SLAVE units. Return test set for repair if necessary.
H-02	No data information received from SLAVE.	1. Excessive noise on circuit.	1. Check circuit noise.
		2. 4942A problem.	2. Perform SELF CHECK on SLAVE unit. Return test set for repair if necessary.
H-03	Data errors.	1. Excessive noise on circuit.	1. Check circuit noise.
		2. 4942A problem.	2. Perform SELF CHECK on MASTER unit. Return test set for repair if necessary.
H-04	Data errors.	1. 4942A problem.	1. Perform SELF CHECK on MASTER and SLAVE units. Return test set for repair if necessary.
H-05	Inappropriate response to MASTER-SLAVE commands.	1. 4942A problem.	1. Perform SELF CHECK on MASTER and SLAVE units. Return test set for repair if necessary.
		2. Distortion on circuit due to high level or circuit malfunction.	2. Check MASTER and SLAVE OUTPUT LEVELS.
H-06	SLAVE not responding to MASTER command.	1. MASTER OUTPUT LEVEL set too low.	1. Check MASTER OUTPUT LEVEL.
		2. Excessive circuit loss.	2. Check that SLAVE receives at least –40 dBm.
		3. Excessive noise on circuit.	3. Check circuit noise.
		4. 4942A problem.	4. Perform SELF CHECK on MASTER and SLAVE units. Return test set for repair if necessary.
H-07	Incompatible SLAVE measurement.	1. SLAVE can make requested measurement only in LINE LOOP BACK.	1. SLAVE must be compatible with MASTER (or it aborts to LINE LOOP BACK mode for measurements not available in SLAVE unit).

Table 3-1. Condition Codes (2 of 2)

CONDITION CODE	MESSAGE	PROBABLE CAUSES	RECOMMENDED ACTIONS
H-08	Invalid command.	1. MASTER MEASUREMENT Switch set to LINE LOOP BACK.	1. Set MASTER MEASUREMENT Switch to valid position.
		2. 4942A problem.	2. Perform SELF CHECK on MASTER unit. Return test set for repair if necessary.
H-09	No data received when expected.	1. Circuit dropout.	1. Check circuit; re-run test.
		2. SLAVE OUTPUT CONTROL moved during data transmission.	2. Do not touch SLAVE OUTPUT CONTROL while measurement in progress.
		3. 4942A problem.	3. Perform SELF CHECK on MASTER and SLAVE units. Return test set for repair if necessary.
H-10	SLAVE Underrange; test Level or Noise below range capability.	1. Normal condition.	1. None
H-11	MASTER receives incorrect response.	1. RCV-TRMT Switch changed during data transmission.	1. Do not touch RCV-TRMT Switch while measurement in progress.
		2. 4942A problem.	2. Perform SELF CHECK on MASTER and SLAVE units. Return test set for repair if necessary.
H-12	IMPULSE NOISE accumulator overflow.	1. IMPULSE NOISE exceeded 9999 COUNTS.	1. Use shorter counting interval.
H-13	SLAVE aborted control of MASTER.	1. SLAVE REMOTE Switch changed to NORMAL or MASTER during data transmission.	1. Do not touch SLAVE REMOTE Switch while measurement in progress.
H-14	Signal dropout >1 Sec. during IMPULSE NOISE measurement.	1. Circuit dropped out carrier.	1. Initiate new test.

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3-9. OPERATION USING HP-IB (Option 010)

3-10. The HP-IB option adds remote programming and data output capability to the 4942A. The allowable instructions for use with the 4942A are given in Table 3-2 and Table 3-3. The HP-IB output data format is given in Table 3-4. In order to use the instructions and output data, the operator must be familiar with the HP-IB and the 4942A. The sample programs given in this manual should also be reviewed.

3-11. First perform the HP-IB setup procedures as explained in the Installation section of this manual. Procedures are given there for address selection, if needed. However, it may be adequate to use the factory preset address as is. The preset talk address is "J"; the listen address is " * ".

3-12. PROGRAMMABILITY

3-13. Most front panel controls are remotely programmable via HP-IB. The exceptions are:

a. POWER switch.

b. SETUP CONTROLS.

c. TRANSMITTER OUTPUT LEVEL.

d. IMPULSE NOISE THRESHOLD thumbwheel switches.

e. LINE MONITOR VOLUME.

These controls must be set manually by the operator before proceeding with the use of remote HP-IB operation.

3-14. PROGRAMMING PROCEDURES (*An Example*)

3-15. The following procedures assume the use of a 9830A Calculator, a 9866A Printer, an HP-IB Interface Kit, and an interface bus cable.

a. Set the non-programmable controls (as listed under PROGRAMMABILITY above) to desired settings.

b. Connect the 4942A to the telephone circuit under test or perform (c) below.

c. Loop the 4942A back on itself by connecting jumpers between the front panel TIP (T) and RING (R) jacks.

d. Execute the Remote Enable command to set the bus to remote.

example:
```
1Ø CMD "?U"
2Ø FORMAT B
3Ø OUTPUT (13,2Ø) 768;
```

e. Address the 4942A to listen and wait 1/2 second for the 4942A to respond to remote enable.

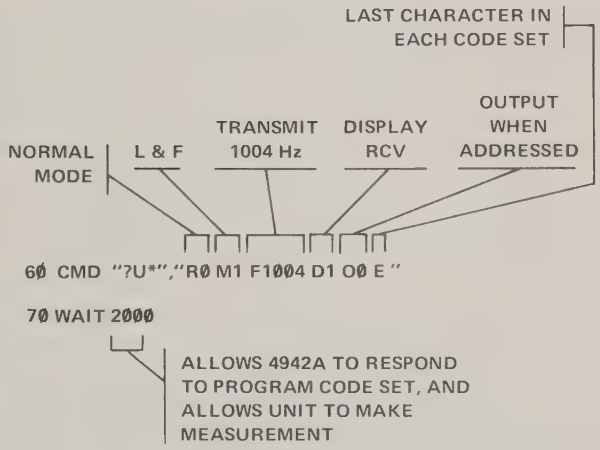
example:
```
4Ø CMD "?U *"
5Ø WAIT 5ØØ
```

NOTE

An internal device clear (DCL) is issued when 4942A is set to remote. See Table 3-3 for 4942A preset conditions with the Device Clear operation.

f. Select the measurement mode and other necessary switch settings:

example:


LAST CHARACTER IN EACH CODE SET
NORMAL MODE
L & F
TRANSMIT 1004 Hz
DISPLAY RCV
OUTPUT WHEN ADDRESSED
6Ø CMD "?U*","RØ M1 F1ØØ4 D1 OØ E "
7Ø WAIT 2ØØØ
ALLOWS 4942A TO RESPOND TO PROGRAM CODE SET, AND ALLOWS UNIT TO MAKE MEASUREMENT

NOTE

The letter "E" must be used at the end of every code set. Without this "execute" code, the 4942A will not respond.

g. Address the 4942A to talk and allow calculator to retrieve the measurement data.

example:
```
8Ø  CMD "?J5"
9Ø  FORMAT 2F7.Ø
1ØØ ENTER (13,9Ø) A,B
```

VARIABLES NOTE: "A" represents data retrieved from left display, i.e., DBM. "B" represents data from right display, i.e., TRMT HZ.

FORMAT NOTE

2F7.0 allows entry of two sets of data, both the left and right display groups. No need to allow a decimal point specification (i.e., F7.1, F7.0). The 4942A outputs a decimal point when needed (see Table 3-4).

h. Print the measurement data with appropriate units.

```
example: 11Ø PRINT "LEV & FREQ DATA"
         12Ø PRINT
         13Ø PRINT A; "DBM AT";B;"RCV HZ"
         14Ø PRINT
```

i. The measurement is finished. If desired, execute the Set Local command (remote disable), and return the 4942A to local (manual) control.

```
example: 15Ø CMD "?U"
         16Ø FORMAT B
         17Ø OUTPUT (13,15Ø) 1Ø24;
         18Ø END
```

NOTE

The Set Local command sets all instruments on the bus to local control. This command not normally used.

3-16. TIMING CONSIDERATIONS

3-17. The 4942A does not respond instantly to measurement commands, nor does the telephone circuit under test settle immediately. Timing considerations therefore play an important role when writing software. Table 3-5 lists the timing delays necessary for the 4942A. Timing delays necessary for the circuit under test will need to be determined by observation or by experiment.

3-18. MULTIPLE READINGS ON THE SAME MEASUREMENT MODE

3-19. Normal operation of the 4942A allows the retrieval of measured data once per measurement selection. For instance, in a program sequence such as:

```
          4Ø FORMAT 2F7.Ø
          5Ø ENTER (13,4Ø) A,B
Not Allowed ──► 6Ø ENTER (13,4Ø) A,B
```

The second ENTER statement is not allowed. The program will "hang up" because the 4942A is not prepared to output at this time.

3-20. An easy solution to this problem is to reissue the entire measurement command sequence. For instance, where three consecutive Level & Frequency measurements are to be made, at 10 second intervals:

```
.
.
12Ø FOR N= 1 TO 3
13Ø CMD "?U*","RØM1F1ØØ4D1OØE"
14Ø WAIT 2ØØØ
15Ø CMD "?J5"
16Ø FORMAT 2F7.Ø
17Ø ENTER (13,16Ø) A,B
18Ø PRINT A,B
19Ø WAIT 8ØØØ
2ØØ NEXT N
21Ø REM CONTINUE PROGRAM
22Ø REM AFTER 3 MEASUREMENTS
.
.
```

3-21. The above program sequence takes three consecutive measurements and prints the measured values. An alternative to the above sequence for simply saving the measured values would be:

```
.
.
12Ø FOR N = 1 TO 3
13Ø CMD "?U*","RØM1F1ØØ4D1OØE"
14Ø WAIT 2ØØØ
15Ø CMD "?J5"
16Ø FORMAT 2F7.Ø
17Ø ENTER (13,16Ø) A[N],B[N]
18Ø WAIT 8ØØØ
19Ø NEXT N
.
.
```

The above program sequence stores the measured data into a 2 x 3 array. The variables A1 and B1 contain data from the first measurement, A2 and B2 from the second, and A3 and B3 from the last.

3-9. OPERATION USING HP-IB (Option 010)

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NOTE

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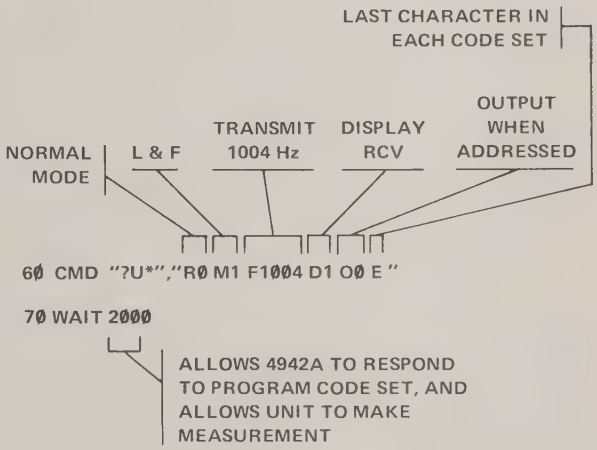
LAST CHARACTER IN EACH CODE SET
OUTPUT WHEN ADDRESSED
TRANSMIT 1004 Hz
DISPLAY RCV
NORMAL MODE
L & F
6Ø CMD "?U*","RØ M1 F1ØØ4 D1 OØ E "
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ALLOWS 4942A TO RESPOND TO PROGRAM CODE SET, AND ALLOWS UNIT TO MAKE MEASUREMENT

NOTE

The letter "E" must be used at the end of every code set. Without this "execute" code, the 4942A will not respond.

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1ØØ ENTER (13,9Ø) A,B
```

VARIABLES NOTE: "A" represents data retrieved from left display, i.e., DBM. "B" represents data from right display, i.e., TRMT HZ.

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2F7.0 allows entry of two sets of data, both the left and right display groups. No need to allow a decimal point specification (i.e., F7.1, F7.0). The 4942A outputs a decimal point when needed (see Table 3-4).

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```
example: 11Ø PRINT "LEV & FREQ DATA"
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         13Ø PRINT A; "DBM AT";B;"RCV HZ"
         14Ø PRINT
```

i. The measurement is finished. If desired, execute the Set Local command (remote disable), and return the 4942A to local (manual) control.

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example: 15Ø CMD "?U"
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         18Ø END
```

NOTE

The Set Local command sets all instruments on the bus to local control. This command not normally used.

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15Ø CMD "?J5"
16Ø FORMAT 2F7.Ø
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.
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16Ø FORMAT 2F7.Ø
17Ø ENTER (13,16Ø) A[N],B[N]
18Ø WAIT 8ØØØ
19Ø NEXT N
.
.
```

The above program sequence stores the measured data into a 2 x 3 array. The variables A1 and B1 contain data from the first measurement, A2 and B2 from the second, and A3 and B3 from the last.

3-22. PARTIAL CHANGE OF MEASUREMENT PARAMETERS

3-23. When a partial change of measurement parameters is needed, only the changed parameter need be attended to. In effect, the 4942A "remembers" all previous instructions except the changed portion of the instruction. Refer to Figure 3-3. Notice that once the basic measurement is set up, the transmitted frequency is changed independently. The other parameters, such as setting the measurement to level and frequency, are left unchanged.

3-24. DETECTING INVALID MEASUREMENT DATA

3-25. After entering any measurement data (such as dBm, Hz, etc.), the data should be checked for validity before use. Three checks can be made of the data. First, determine if an H-code has been entered. Secondly, determine if an out of range (overrange or underrange) condition exists. Finally, check if a frequency error has occurred. For instance, if a measurement instruction specifies an 804 Hz transmit frequency by a master unit, did the slave receive it?

3-26. An H-code is indicated by a range of numbers in the left display data. An H-code appears as the numbers 9900 to 9914, when the left display does not contain a decimal point. H-codes appear as the numbers 90 to 91.4 in the left display data when the measurement contains a decimal point. An out of range is indicated by 99.9 or 9999 or –99.9 or –9999 in the left display data. No distinction can be made between overrange and underrange in the bus data, as unreliable results occur. The following program steps illustrate the procedure.

```
.
.
110 FORMAT 2F7.0
120 ENTER (13,110) A,B
130 IF A>=9900 AND A<=9914 THEN 560
140 IF A>=90 AND A<=91.4 THEN 660
150 IF A=99.9 OR A=9999 OR A=-99.9 OR
    A=-9999 THEN 760
160 IF B>=(N+10) OR B<=(N-10) THEN
    860
170 REM PROGRAM EXECUTION
180 REM CONTINUES HERE
.
.
560 REM BEGIN H-CODE PRINT SUB.
570 REM FOR NON-D.P. ERRORS
.
.
660 REM BEGIN H-CODE PRINT SUB.
670 REM FOR D.P. TYPE ERRORS
.
.
760 REM BEGIN OUT OF RANGE
770 REM PRINT SUBROUTINE
.
.
860 REM BEGIN INVALID TRMT FREQ
870 REM PRINT SUBROUTINE
.
.
```

3-27. Line 120 enters the data into the calculator. Line 130 checks for an H-code in the left display data, assuming a non-decimal point entry. Line 140 checks for an H-code assuming a decimal point entry. Line 150 checks for an out of range condition.

3-28. Line 160 checks for the proper transmit frequency (plus or minus 10 Hz), where the variable "N" represents the intended frequency.

3-29. SERVICE REQUESTS AND SERIAL POLLING

3-30. Table 3-6 gives the basic serial poll procedures. The sample program excerpt in Figure 3-5 uses these procedures. The 4942A will output a service request at the end of a measurement if the output identifier "O1" is used. The exception is during or after an impulse noise measurement using the non-stop feature. The 4942A will not output a service request under these conditions.

3-31. SELF-CHECK USING HP-IB

3-32. The automatic self-check operation may be initiated using HP-IB. The displayed data of self-check is not retrievable, nor are the H-codes. However, once self-check has finished, the display data may be entered. A "passed" condition is indicated by "9950" in the left display data. If self-check has failed, the 4942A display is viewed to determine the H-codes present. Figure 3-8 gives an example of this operation.

Table 3-2. HP-IB Program Code Set

CHARACTER (ASCII CODE)	FUNCTION	OCTAL CODE	DECIMAL CODE
R	Remote (Master-Slave) Identifier	122	82
0	Normal	60	48
1	Master & Master-to-Slave	61	49
2	Master & Slave-to-Master	62	50
3	Slave	63	51
M	Measurement Identifier	115	77
1	Level & Frequency	61	49
2	C-Message Noise	62	50
3	Noise-with-Tone	63	51
4	Signal-to-Noise	64	52
5	Impulse Noise	65	53
6	Envelope Delay (Display ED & Freq.)	66	54
7	Line Loop Back	67	55
D	Display Identifier	104	68
0	Display Transmitter	60	48
1	Display Receiver	61	49
2	Display Delay (use with M6)	62	50
3	Display Level (use with M6)	63	51
F	Frequency Identifier	106	70
(x)xxx	Any Frequency between 204 Hz and 3904 Hz	–	–
Z	Zero Identifier	132	90
0	Level Zero	60	48
1	Delay Zero	61	49
P	Impulse Noise Period Identifier	120	80
0	5 Minutes	60	48
1	15 Minutes	61	49
2	Non-Stop	62	50
I	Impulse Noise Identifier	111	73
0	Stop	60	48
1	Start/Reset	61	49
L	Delay Identifier	114	76
0	Envelope Delay Normal Set	60	48
1	Envelope Delay Repeat Set	61	49
O	Output Identifier	117	79
0	Output measurement data when addressed.	60	48
1	Pull Service Request to output data.	61	49
S	Self Check Identifier	123	83
0	Stop	60	48
1	Start	61	49
E	Execute Identifier Note: "E" must be last character in each program code set. Example: CMD "?U✱ ", "M1E"	105	69
Factory Preset Address: Talk = J, Listen = ✱			

Table 3-3. Allowable HP-IB Bus Commands

OPERATION	DESCRIPTION	9830A EXAMPLE
Remote Enable	Enables remote operation of devices on the bus.	10 CMD "?U" 20 FORMAT B 30 OUTPUT (13,20) 768;
Set Local	Returns all devices to local control.	100 CMD "?U" 110 FORMAT B 120 OUTPUT (13,110) 1024;
Unlisten (UNL)	Clears bus of all listeners.	10 CMD "?"
Untalk (UNT)	Unaddresses the current talker so that no talker remains on the bus.	10 CMD "?U" 20 FORMAT 3B 30 OUTPUT (13,20) 256,95,512;
Device Clear (DCL)	Returns 4942A to following setup: Normal Level & Frequency 1004 Hz Display Level Master-to-Slave No Self Check Non-Stop	10 CMD "?U" 20 FORMAT 3B 30 OUTPUT (13,20) 256,20,512;
Interface Clear (IFC)	Stops all input/output operations on bus by unaddressing all talkers and listeners.	Press STOP key
Go to Local (GTL)	Returns the 4942A to local control when addressed to listen.	10 CMD "?U*" 20 FORMAT 3B 30 OUTPUT (13,20) 256,1,512;

3-33. SF SKIP OPERATION

3-34. The SF SKIP setup control switch does not function during remote HP-IB operation. If the single frequency skip function is desired, it must be implemented in the customer written software. Such an example is shown in the sample program of Figure 3-4.

Table 3-4. HP-IB Output Data Format (1 of 2)

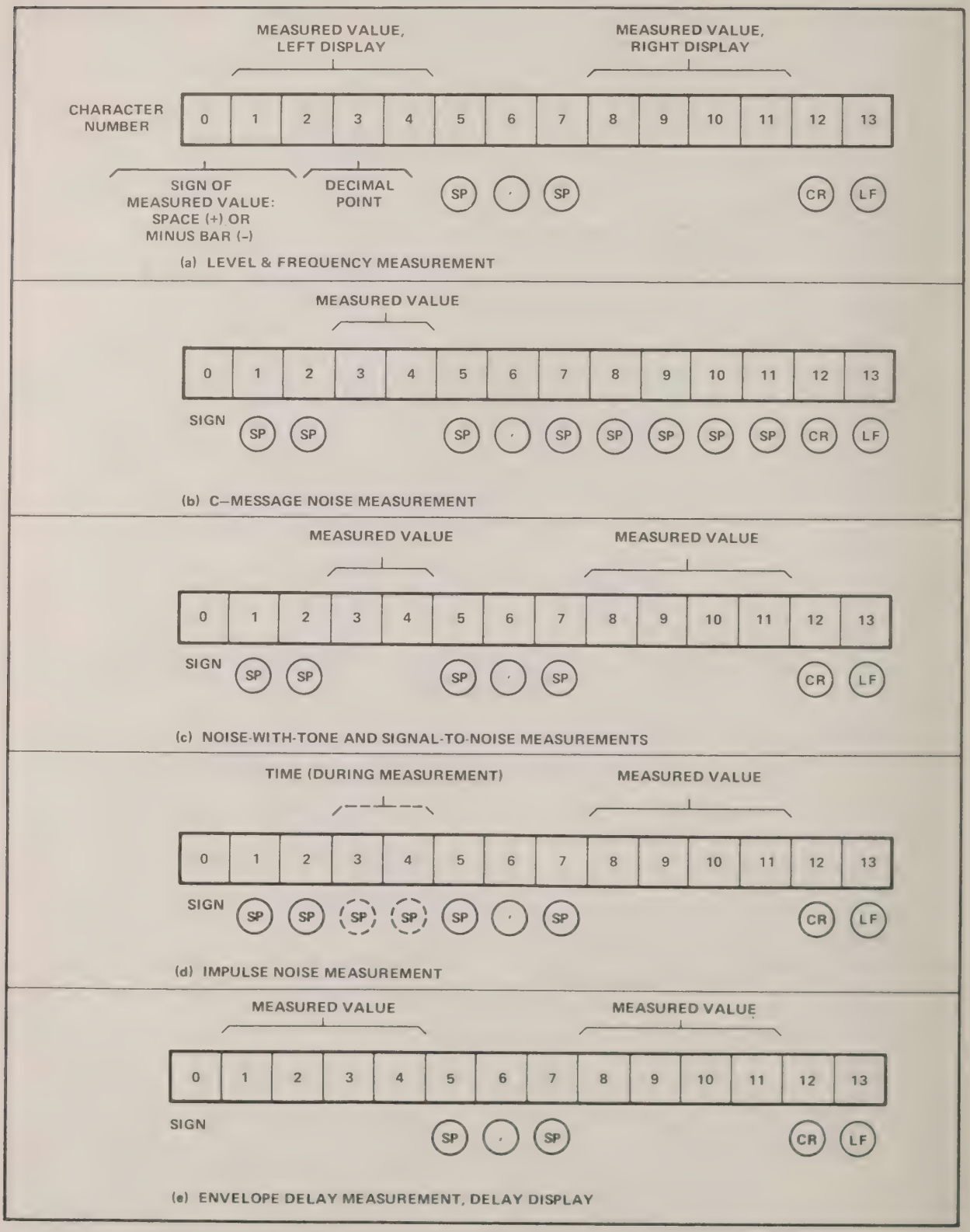
MEASURED VALUE, LEFT DISPLAY
MEASURED VALUE, RIGHT DISPLAY
CHARACTER NUMBER
0 1 2 3 4 5 6 7 8 9 10 11 12 13
SIGN OF MEASURED VALUE: SPACE (+) OR MINUS BAR (-)
DECIMAL POINT
SP . SP
CR LF
(a) LEVEL & FREQUENCY MEASUREMENT
MEASURED VALUE
0 1 2 3 4 5 6 7 8 9 10 11 12 13
SIGN
SP SP SP . SP SP SP SP SP CR LF
(b) C–MESSAGE NOISE MEASUREMENT
MEASURED VALUE
MEASURED VALUE
0 1 2 3 4 5 6 7 8 9 10 11 12 13
SIGN
SP SP SP . SP CR LF
(c) NOISE-WITH-TONE AND SIGNAL-TO-NOISE MEASUREMENTS
TIME (DURING MEASUREMENT)
MEASURED VALUE
0 1 2 3 4 5 6 7 8 9 10 11 12 13
SIGN
SP SP SP SP SP . SP CR LF
(d) IMPULSE NOISE MEASUREMENT
MEASURED VALUE
MEASURED VALUE
0 1 2 3 4 5 6 7 8 9 10 11 12 13
SIGN
SP . SP CR LF
(e) ENVELOPE DELAY MEASUREMENT, DELAY DISPLAY

Table 3-4. HP-IB Output Data Format (2 of 2)

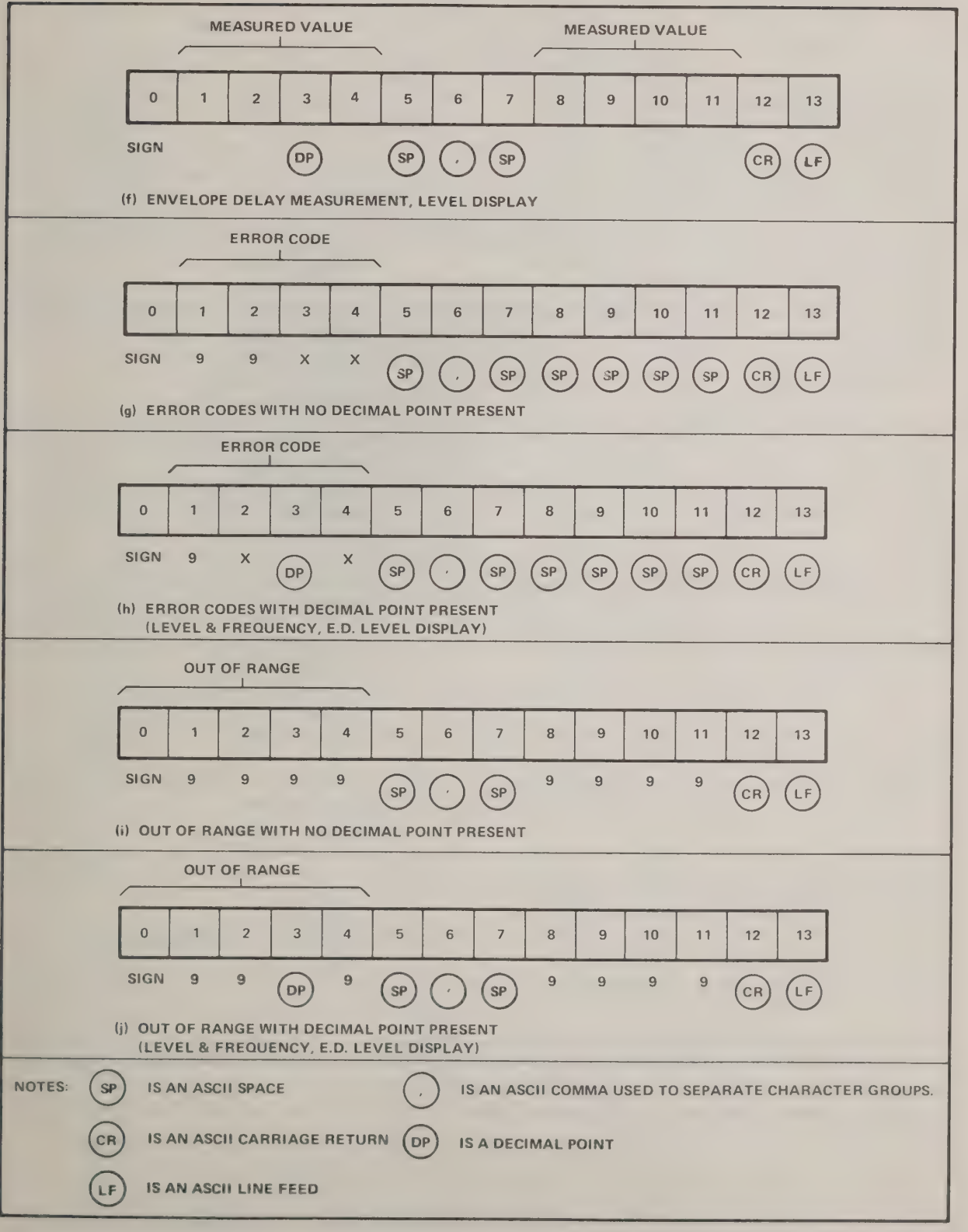
MEASURED VALUE
MEASURED VALUE
0 1 2 3 4 5 6 7 8 9 10 11 12 13
SIGN DP SP , SP CR LF
(f) ENVELOPE DELAY MEASUREMENT, LEVEL DISPLAY
ERROR CODE
0 1 2 3 4 5 6 7 8 9 10 11 12 13
SIGN 9 9 X X SP , SP SP SP SP SP CR LF
(g) ERROR CODES WITH NO DECIMAL POINT PRESENT
ERROR CODE
0 1 2 3 4 5 6 7 8 9 10 11 12 13
SIGN 9 X DP X SP , SP SP SP SP SP CR LF
(h) ERROR CODES WITH DECIMAL POINT PRESENT
(LEVEL & FREQUENCY, E.D. LEVEL DISPLAY)
OUT OF RANGE
0 1 2 3 4 5 6 7 8 9 10 11 12 13
SIGN 9 9 9 9 SP , SP 9 9 9 9 CR LF
(i) OUT OF RANGE WITH NO DECIMAL POINT PRESENT
OUT OF RANGE
0 1 2 3 4 5 6 7 8 9 10 11 12 13
SIGN 9 9 DP 9 SP , SP 9 9 9 9 CR LF
(j) OUT OF RANGE WITH DECIMAL POINT PRESENT
(LEVEL & FREQUENCY, E.D. LEVEL DISPLAY)
NOTES: SP IS AN ASCII SPACE
, IS AN ASCII COMMA USED TO SEPARATE CHARACTER GROUPS.
CR IS AN ASCII CARRIAGE RETURN
DP IS A DECIMAL POINT
LF IS AN ASCII LINE FEED

Table 3-5. Timing Considerations

ACTION	RECOMMENDED MAXIMUM DELAYS *Note 1*	9830A EXAMPLE
Address 4942A to "listen" to remote enable	1/2 second	140 CMD "?U*" 150 WAIT 500
Set measurement, normal mode.	2 seconds	1500 CMD "?U*", "R0M1D1O1E" 1610 WAIT 2000
Set measurement, master-slave mode, master-to-slave	10 seconds *Note 2*	2220 CMD "?U*", "R1M1D1F1004O0E" 2230 WAIT 10000
Set measurement, master-slave mode, slave-to-master	10 seconds *Note 2*	2320 CMD "?U*", "R2M1D1F1004O0E" 2330 WAIT 10000
Level zero, normal mode	1/4 second	10 CMD "?U*", "Z0E" 20 WAIT 250
Level zero, master-slave mode	2 seconds	2240 CMD "?U*", "Z0E" 2250 WAIT 2000
Delay zero, normal mode	1/2 second	60 CMD "?U*", "Z1E" 70 WAIT 500
Delay zero, master-slave mode	1/2 second	90 CMD "?U*", "Z1E" 100 WAIT 500
Change transmit frequency	2 seconds	2420 FOR N = 204 TO 3804 STEP 400 2430 CMD "?U*" 2440 FORMAT "F", F1000.0, "E" 2450 OUTPUT (13,2440) N 2460 WAIT 2000
Start self check	70 seconds	180 CMD "?U*", "S1E" 190 WAIT 30000 200 WAIT 30000 210 WAIT 10000
Issue bus commands GTL and DCL	2 seconds	710 CMD "?U" 720 FORMAT 3B 730 OUTPUT (13,720)256,20 ,512; 740 WAIT 2000

NOTE 1. The delay values recommended are usually needed to allow the 4942A to settle, and to prevent erroneous data entry. The delays presented are therefore typical maximum values. The user is encouraged to try shorter delay times when system efficiency is needed. The controller can be servicing other equipment during the wait time.

NOTE 2. If an output of absolute value (i.e., dBm) is requested (entered) before a level zero or delay zero, a wait of one second is adequate.

Table 3-6. Service Requests and Serial Polling

OPERATION	DESCRIPTION	9830A EXAMPLE
Check for Service Request (SRQ)	Determines whether service has been requested by any device.	580 CMD "?U" 590 IF STAT13 <=1 THEN 160
Starting a Poll (SPE)	Set the serial poll mode; also use untalk command and address calculator to listen.	180 CMD "?U" 190 FORMAT 5B 200 OUTPUT (13,190) 256,95,53,24,512;
Polling a Device	Address a talker (the polled device). The polled device sends a status byte indicating the device condition. The variable will contain the decimal equivalent of the byte. Decimal equivalent is "80" for 4942A when service requested.	220 CMD "J" 230 Q = RBYTE13 Note: Variable Q now contains value of RBYTE13. If 80, then service requested by 4942A
Ending a Poll (SPD)	Serial Poll Disable terminates the serial poll mode.	250 CMD "?U" 260 FORMAT 3B 270 OUTPUT (13,260) 256,25,512;
Determine if 4942A requested service	Checks to see if the 4942A was the instrument on the bus which requested service.	290 IF Q = 80 THEN 1390

SAMPLE PROGRAM EXCERPT

PURPOSE: Select LEVEL & FREQUENCY and step transmitted frequency in 100 Hz steps, from 204 Hz to 3904 Hz.

TECHNIQUE: Set up FOR-NEXT loop to step frequency and use OUTPUT and FORMAT statements to output the stepped variable N (frequency) as a program code.

•
•
•

```
100 CMD "?U*","R0M1F1004D0E"
110 WAIT 2000
120 FOR N=204 TO 3904 STEP 100
130 FORMAT "F",F1000.0,"E"
140 OUTPUT (13,130)N
150 WAIT 2000
160 NEXT N
```

•
•
•

Figure 3-3. Programming Level & Frequency Transmitter (1 of 3)

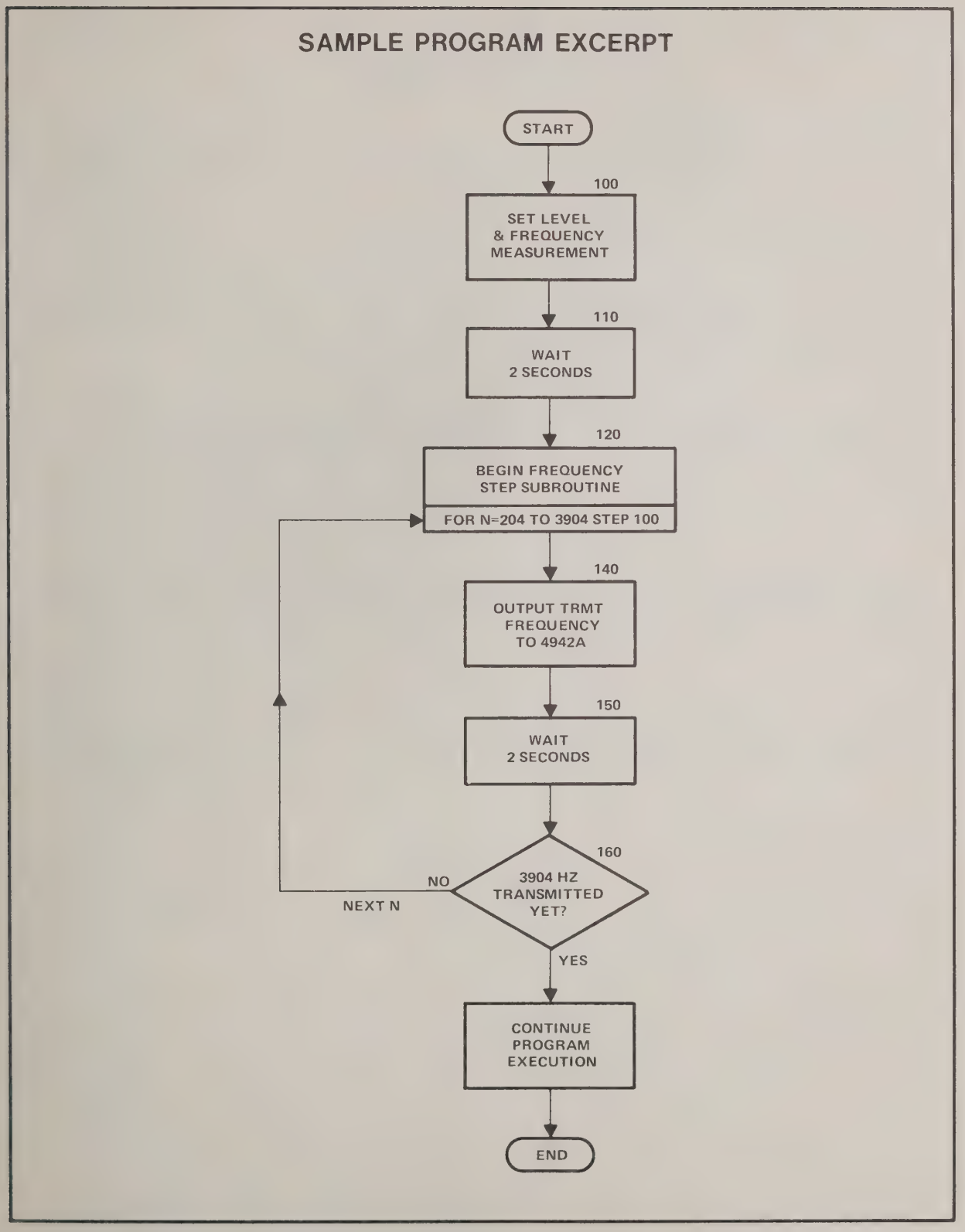

Figure 3-3. Programming Level & Frequency Transmitter (2 of 3)

SAMPLE PROGRAM EXCERPT

LINE NO.	EXPLANATION
100	Set measurement in 4942A
110*	Wait 2 seconds for 4942A to digest instructions.
120	Start the FOR-NEXT loop to step the frequency. Start at 204 Hz.
130	When N is output with line 140, the command will be sent as: "F204E", "F304E", "F404E", and etc. to "F3904E".
140	Outputs the frequency to be transmitted as variable N.
150*	Wait 2 seconds allowing 4942A to change frequency.
160	Go back to beginning of loop to transmit another frequency.

*Depending on individual program and/or measurement needs, the delay needed may vary. This is best determined empirically with the test setup to be used and the circuit under test.

Figure 3-3. Programming Level & Frequency Transmitter (3 of 3)

SAMPLE PROGRAM

PURPOSE: Using remote master-slave operation, measure all circuit parameters for both directions of transmission. Implement the SF skip function with the program software.

TECHNIQUE:

1. Use the 9830A Calculator to control the master unit using the HP-IB remote interface bus. Print test results with the 9866A Printer.

2. For each measurement parameter, test the master-to-slave direction first, then the slave-to-master direction.

3. Check for possible error conditions such as H-codes, out of range (over or under range), and frequency transmission errors.

4. If an error condition exists, then print the error, stop the measurement, and try the measurement again. If the measurement fails 3 times, then give up and go to the next measurement (i.e., L & F, M-to-S fails 3 times, go to L & F, S-to-M).

5. Make Level & Frequency measurement from 204 to 3804 Hz in 200 Hz steps. Skip 2604 Hz.

6. Set Impulse Noise for 5 minute period.

7. Make Envelope Delay measurements between 204 and 3904 Hz in 100 Hz steps. Skip 2504, 2604, and 2704 Hz. Execute delay zero mathematically at the frequency of minimum delay.

RUNNING TIME: About 15 minutes, with no error conditions.

REMINDER: At both slave and master units, set TRANSMITTER OUTPUT LEVEL (in NORMAL mode) before beginning Master-Slave operation. At slave unit, don't forget to set REMOTE switch to SLAVE position, after transmit levels are set.

Figure 3-4. Programming Master-Slave Operation (1 of 35)

SAMPLE PROGRAM

```
10 REM  BEGIN MASTER-SLAVE SAMPLE PROGRAM
20 REM  VARIABLES ASSIGNMENT:
30 REM   A USED FOR LEFT DISPLAY DATA
40 REM   B USED FOR RIGHT DISPLAY DATA
50 REM   N USED FOR FREQUENCY STEP LOOP
60 REM   T USED FOR MEASUREMENT INDICATOR
70 REM   X USED FOR ERROR COUNTER
80 REM   U USED AS ENV. DEL. ZERO REFERENCE
90 REM   V USED AS ENV. DEL. ZERO FREQUENCY
100 REM  D IS ARRAY VARIABLE FOR E.D. DATA TABLE
110 REM  J IS ARRAY VARIABLE FOR 'DELA' VALUES
120 REM  K IS ARRAY VARIABLE FOR **EW. VALUES
130 A=B=N=X=U=V=D=0
140 T=1
150 OUTPUT (15,310)10,10
160 PRINT "LEVEL & FREQUENCY TEST, MASTER-TO-SLAVE DIRECTION"
170 PRINT
180 CMD "?U"
190 FORMAT B
200 OUTPUT (13,190,768)
210 CMD "?U*"
220 WAIT 500
230 CMD "?U*","R1M1D1F100400E"
240 WAIT 10000
250 GOSUB 560
260 CMD "?U*","Z0F"
270 WAIT 2000
280 GOSUB 420
290 X=0
300 T=2
310 FORMAT 2B
320 OUTPUT (15,310)10,10
330 PRINT "LEVEL & FREQUENCY TEST, SLAVE-TO-MASTER DIRECTION"
340 PRINT
350 CMD "?U*","R2M1D1F100400E"
360 WAIT 10000
370 GOSUB 560
380 CMD "?U*","Z0E"
390 WAIT 2000
400 GOSUB 420
410 GOTO 1820
```

Figure 3-4. Programming Master-Slave Operation (2 of 35)

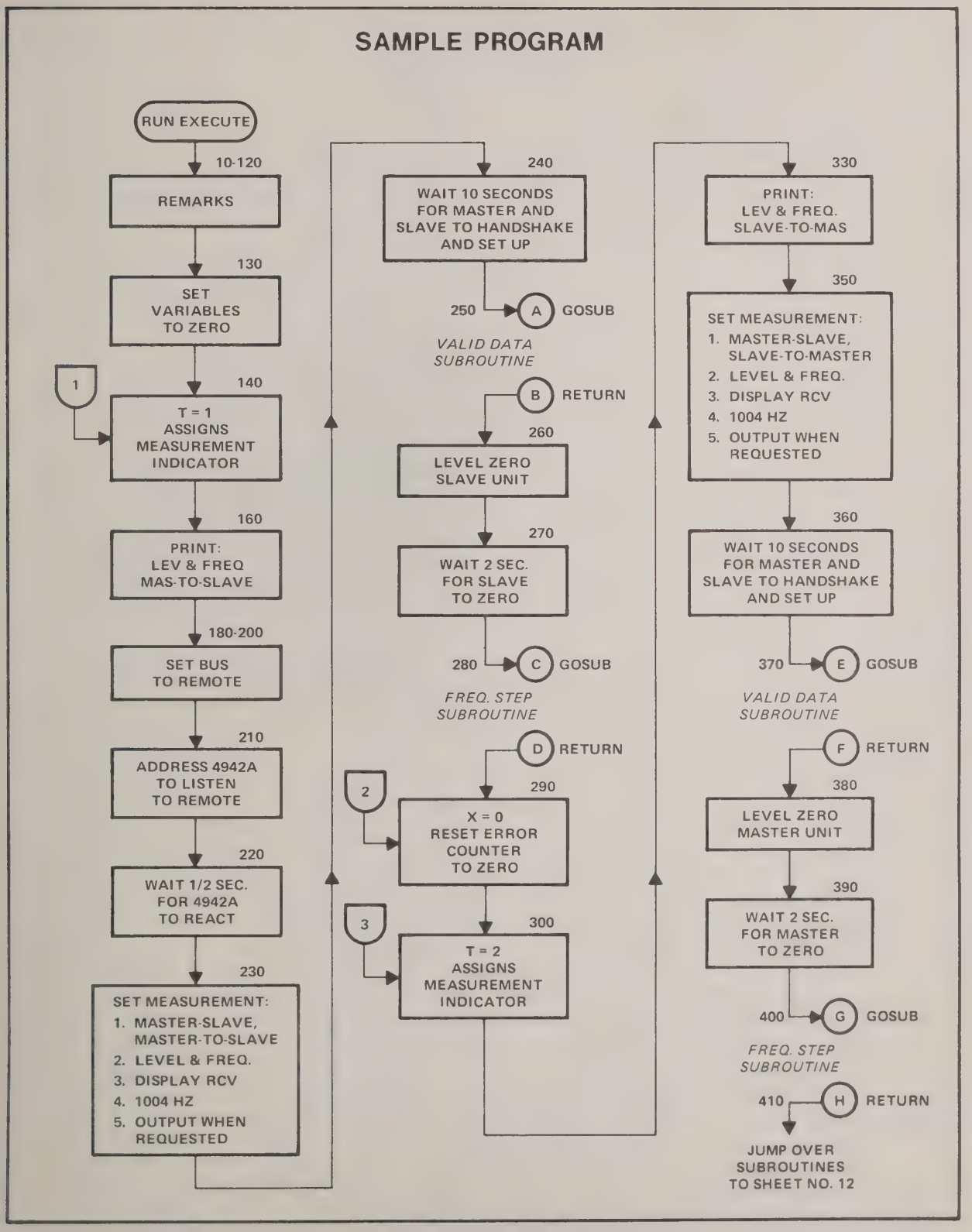

Figure 3-4. Programming Master-Slave Operation (3 of 35)

SAMPLE PROGRAM

```
420 REM BEGIN FREQUENCY STEP SUBROUTINE
430 FOR N=204 TO 3804 STEP 200
440 IF N=2604 THEN 540
450 CMD "?U*"
460 FORMAT "F",F1000.0,"E"
470 OUTPUT (13,460)N
480 WAIT 2000
490 GOSUB 560
500 IF B >= (N+10) OR B <= (N-10) THEN 790
510 REM , IF LAST LINE TRUE, THEN FREQ ERROR PRESENT
520 FORMAT 4X,F1000.0,1X,"DB AT",1X,F1000.0,1X,"HZ"
530 OUTPUT (15,520)A,B
540 NEXT N
550 RETURN
```

Figure 3-4. Programming Master-Slave Operation (4 of 35)

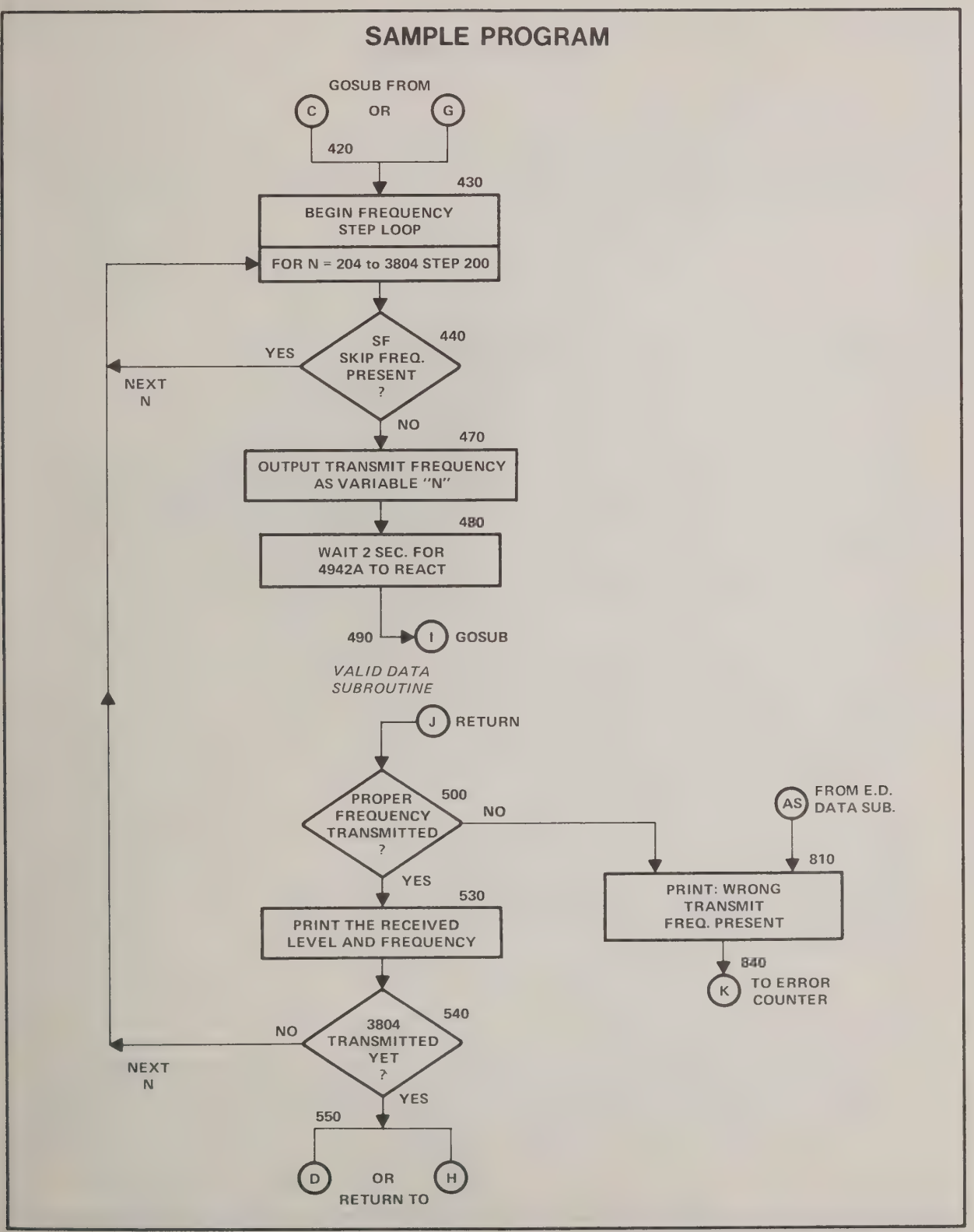

Figure 3-4. Programming Master-Slave Operation (5 of 35)

SAMPLE PROGRAM

```
560 REM  CHECK FOR PRESENCE OF VALID DATA
570 REM  BEFORE CONTINUING MAIN PROGRAM
580 CMD "?J5"
590 FORMAT 2F7.0
600 ENTER (13,590)A,B
610 IF A >= 9900 AND A <= 9914 THEN 670
620 IF A >= 90 AND A <= 91.4 THEN 720
630 REM  IF ONE OF LAST 2 LINES TRUE, THEN ERROR CODE PRESENT
640 IF A=99.9 OR A=9999 OR A=-99.9 OR A=-9999 THEN 760
650 REM IF LAST LINE TRUE, THEN OUT OF RANGE CONDITION
660 RETURN
670 REM  BEGIN NON-D.P. ERROR CODE PRINT SUBROUTINE
680 A=A-9900
690 FORMAT 4X,"ERROR CODE H-",F1000.0,1X,"PRESENT"
700 OUTPUT (15,690)A
710 GOTO 850
720 REM  BEGIN D.P. ERROR CODE PRINT SUBROUTINE
730 A=(A*10)-900
740 OUTPUT (15,690)A
750 GOTO 850
760 REM  BEGIN OUT OF RANGE PRINT SUBROUTINE
770 PRINT "OUT OF RANGE CONDITION PRESENT"
780 GOTO 850
790 REM  BEGIN FREQUENCY ERROR PRINT SUBROUTINE
800 PRINT
810 PRINT "WRONG TRANSMIT FREQUENCY PRESENT-"
820 PRINT "POSSIBLE SIGNAL DROPOUT"
830 PRINT
840 GOTO 850
```

Figure 3-4. Programming Master-Slave Operation (6 of 35)

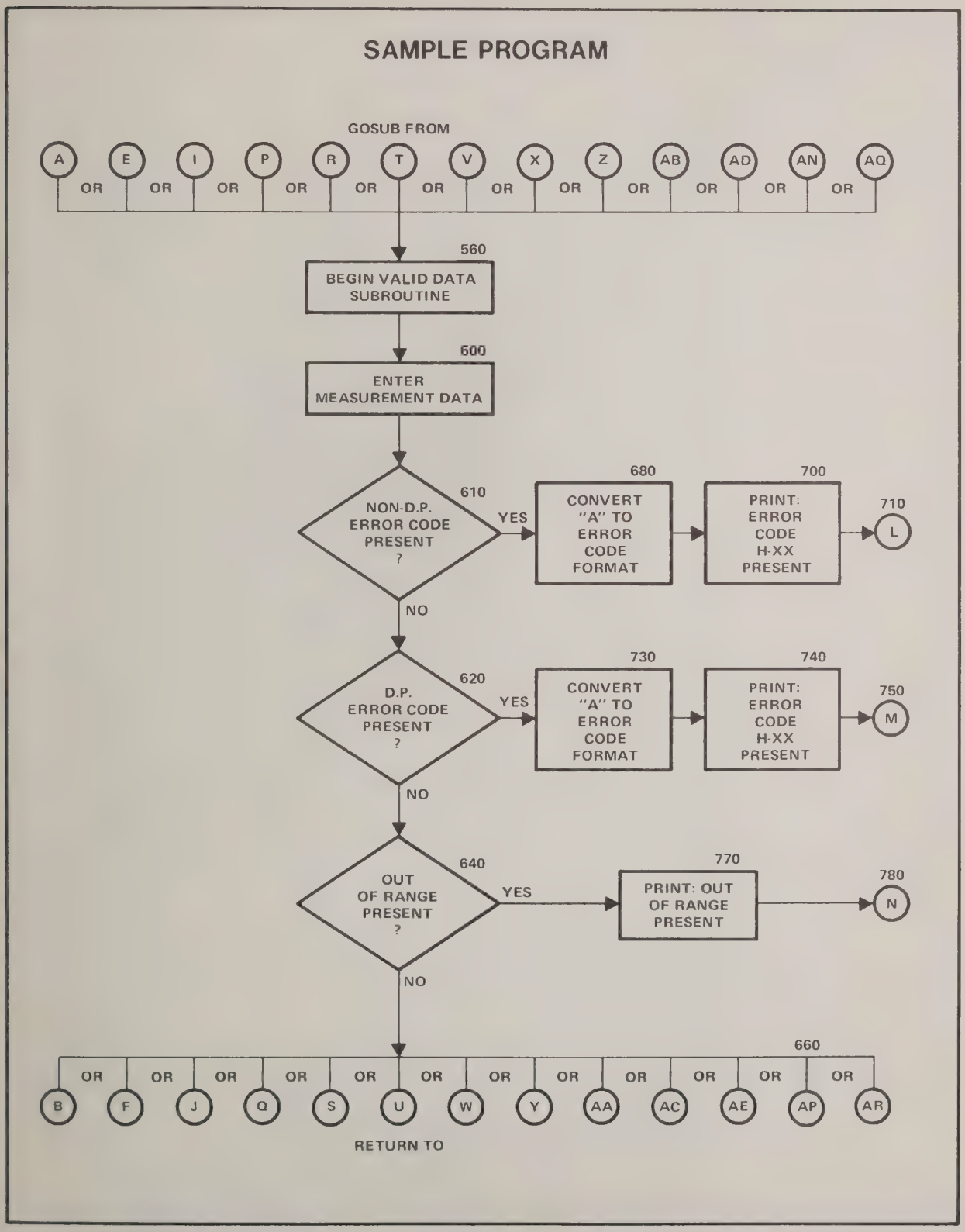

Figure 3-4. Programming Master-Slave Operation (7 of 35)

SAMPLE PROGRAM

```
850 REM  BEGIN ERROR COUNTER
860 IF T=1 THEN 980
870 IF T=2 THEN 1050
880 IF T=3 THEN 1120
890 IF T=4 THEN 1190
900 IF T=5 THEN 1260
910 IF T=6 THEN 1330
920 IF T=7 THEN 1400
930 IF T=8 THEN 1470
940 IF T=9 THEN 1540
950 IF T=10 THEN 1610
960 IF T=11 THEN 1680
970 IF T=12 THEN 1750
980 REM  T=1
990 X=X+1
1000 IF X=3 THEN 290
1010 REM  IF X=3 THEN GO NEXT MSMT
1020 WAIT 2000
1030 REM  TRY T=1 AGAIN
1040 GOTO 140
1050 REM  T=2
1060 X=X+1
1070 IF X=3 THEN 1820
1080 REM  IF X=3 THEN GO NEXT MSMT
1090 WAIT 2000
1100 REM  TRY T=2 AGAIN
1110 GOTO 300
1120 REM  T=3
1130 X=X+1
1140 IF X=3 THEN 1920
1150 REM  IF X=3 THEN GO NEXT MSMT
1160 WAIT 2000
1170 REM  TRY T=3 AGAIN
1180 GOTO 1830
1190 REM  T=4
1200 X=X+1
1210 IF X=3 THEN 2010
1220 REM  IF X=3 THEN GO NEXT MSMT
1230 WAIT 2000
1240 REM  TRY T=4 AGAIN
1250 GOTO 1930
1260 REM  T=5
1270 X=X+1
1280 IF X=3 THEN 2110
1290 REM  IF X=3 THEN GO NEXT MSMT
1300 WAIT 2000
1310 REM  TRY T=5 AGAIN
1320 GOTO 2020
```

Figure 3-4. Programming Master-Slave Operation (8 of 35)

SAMPLE PROGRAM

```
1330 REM  T=6
1340 X=X+1
1350 IF X=3 THEN 2200
1360 REM  IF X=3 THEN GO NEXT MSMT
1370 WAIT 2000
1380 REM  TRY T=6 AGAIN
1390 GOTO 2120
1400 REM  T=7
1410 X=X+1
1420 IF X=3 THEN 2300
1430 REM  IF X=3 THEN GO NEXT MSMT
1440 WAIT 2000
1450 REM  TRY T=7 AGAIN
1460 GOTO 2210
1470 REM  T=8
1480 X=X+1
1490 IF X=3 THEN 2390
1500 REM  IF X=3 THEN GO NEXT MSMT
1510 WAIT 2000
1520 REM  TRY T=8 AGAIN
1530 GOTO 2310
1540 REM  T=9
1550 X=X+1
1560 IF X=3 THEN 2620
1570 REM  IF X=3 THEN GO NEXT MSMT
1580 WAIT 2000
1590 REM  TRY T=9 AGAIN
1600 GOTO 2400
1610 REM  T=10
1620 X=X+1
1630 IF X=3 THEN 2840
1640 REM  IF X=3 THEN GO NEXT MSMT
1650 WAIT 2000
1660 REM  TRY T=10 AGAIN
1670 GOTO 2630
1680 REM  T=11
1690 X=X+1
1700 IF X=3 THEN 2950
1710 REM  IF X=3 THEN GO NEXT MSMT
1720 WAIT 2000
1730 REM  TRY T=11 AGAIN
1740 GOTO 2850
1750 REM  T=12
1760 X=X+1
1770 IF X=3 THEN 3060
1780 REM  IF X=3 THEN GO NEXT MSMT
1790 WAIT 2000
1800 REM  TRY T=12 AGAIN
1810 GOTO 2960
```

Figure 3-4. Programming Master-Slave Operation (9 of 35)

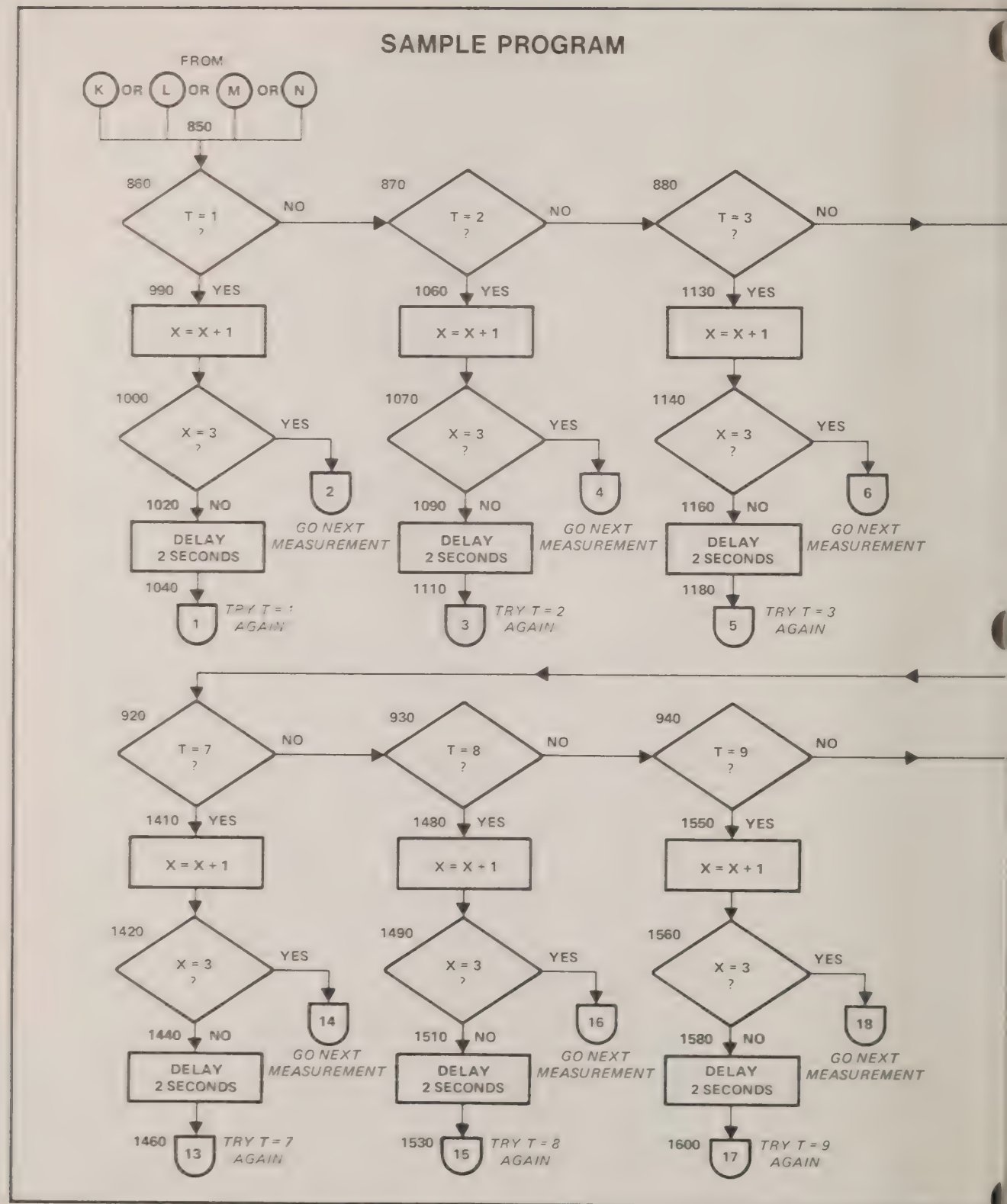

Figure 3-4. Programming Master-Slave Operation (10 of 35)

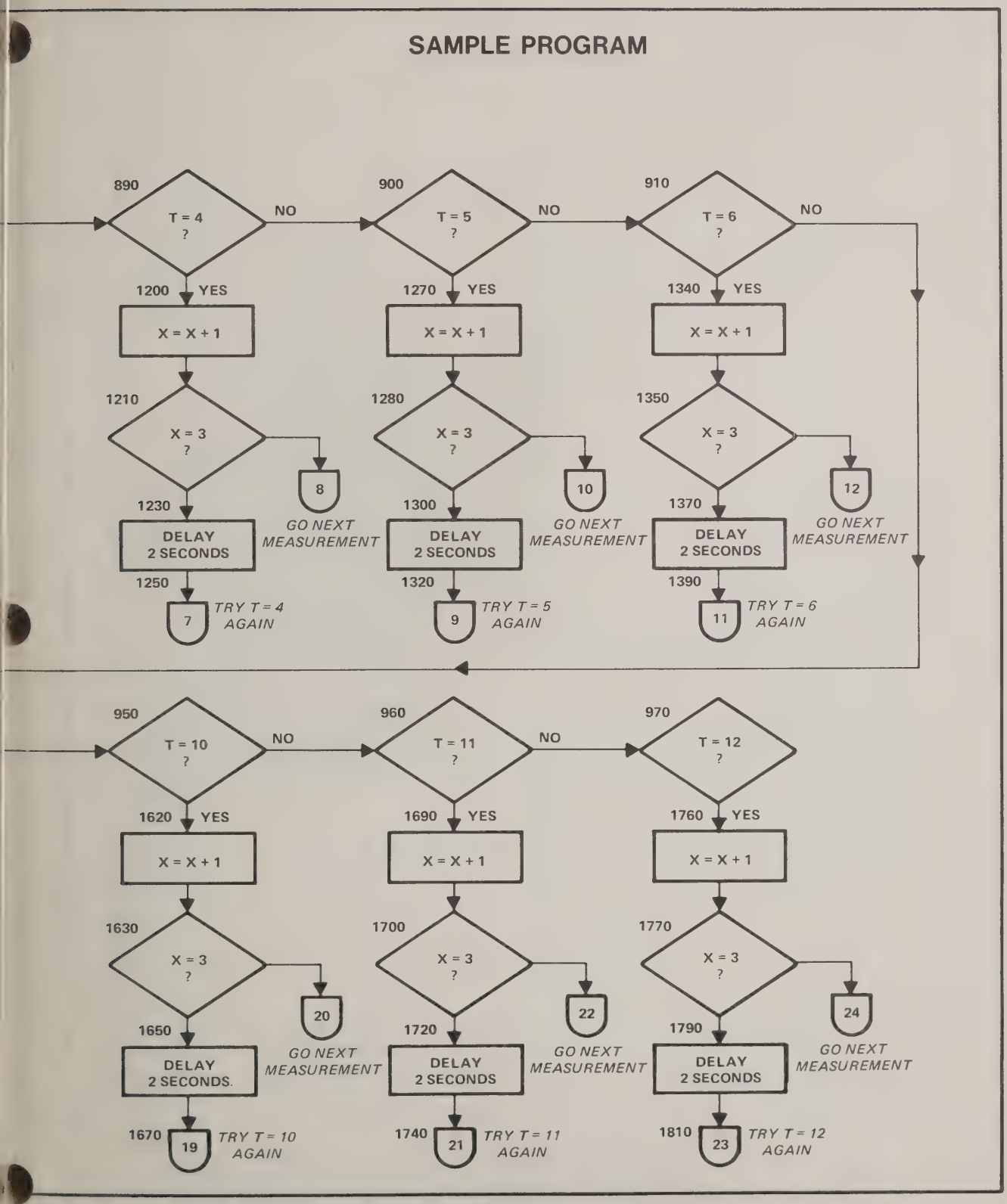

Figure 3-4. Programming Master-Slave Operation (11 of 35)

SAMPLE PROGRAM

```
1820 X=0
1830 T=3
1840 OUTPUT (15,310)10,10
1850 PRINT "C-MESSAGE NOISE TEST, MASTER-TO-SLAVE DIRECTION"
1860 PRINT
1870 CMD "?U*","R1M2E'
1880 WAIT 10000
1890 GOSUB 560
1900 FORMAT 4X,F1000.0,1X,"DBRNC"
1910 OUTPUT (15,1900)A
1920 X=0
1930 T=4
1940 OUTPUT (15,310)10,10
1950 PRINT "C-MESSAGE NOISE TEST, SLAVE-TO-MASTER DIRECTION"
1960 PRINT
1970 CMD "?U*","R2M2E"
1980 WAIT 10000
1990 GOSUB 560
2000 OUTPUT (15,1900)A
```

Figure 3-4. Programming Master-Slave Operation (12 of 35)

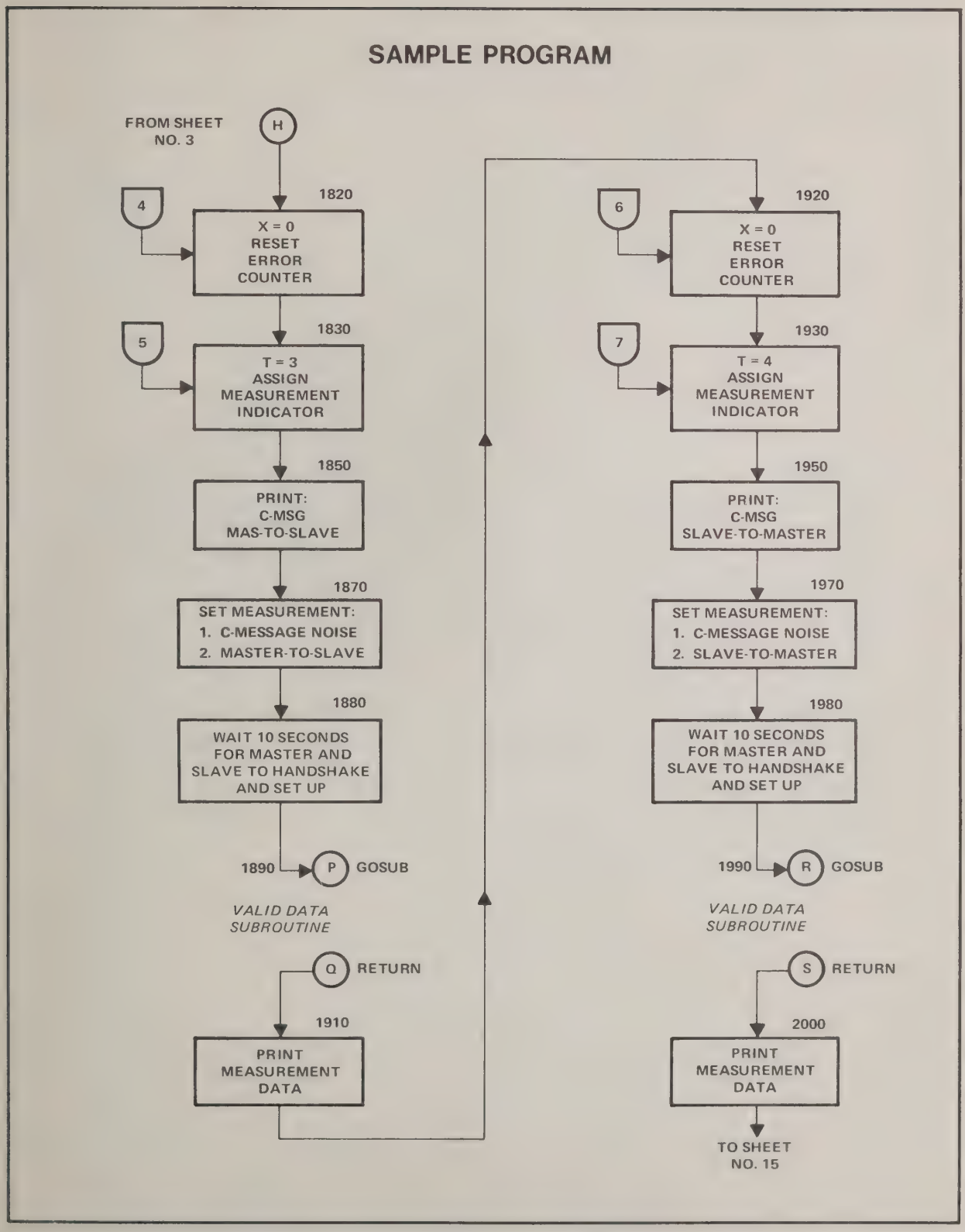

Figure 3-4. Programming Master-Slave Operation (13 of 35)

SAMPLE PROGRAM

```
2010 X=0
2020 T=5
2030 OUTPUT (15,310)10,10
2040 PRINT "NOISE-WITH-TONE TEST, MASTER-TO-SLAVE DIRECTION"
2050 PRINT
2060 CMD "?U*","R1M3E"
2070 WAIT 10000
2080 GOSUB 560
2090 FORMAT 4X,F1000.0,1X,"DBRNC"
2100 OUTPUT (15,2090)A
2110 X=0
2120 T=6
2130 OUTPUT (15,310)10,10
2140 PRINT "NOISE-WITH-TONE TEST, SLAVE-TO-MASTER DIRECTION"
2150 PRINT
2160 CMD "?U*","R2M3E"
2170 WAIT 10000
2180 GOSUB 560
2190 OUTPUT (15,2090)A
```

Figure 3-4. Programming Master-Slave Operation (14 of 35)

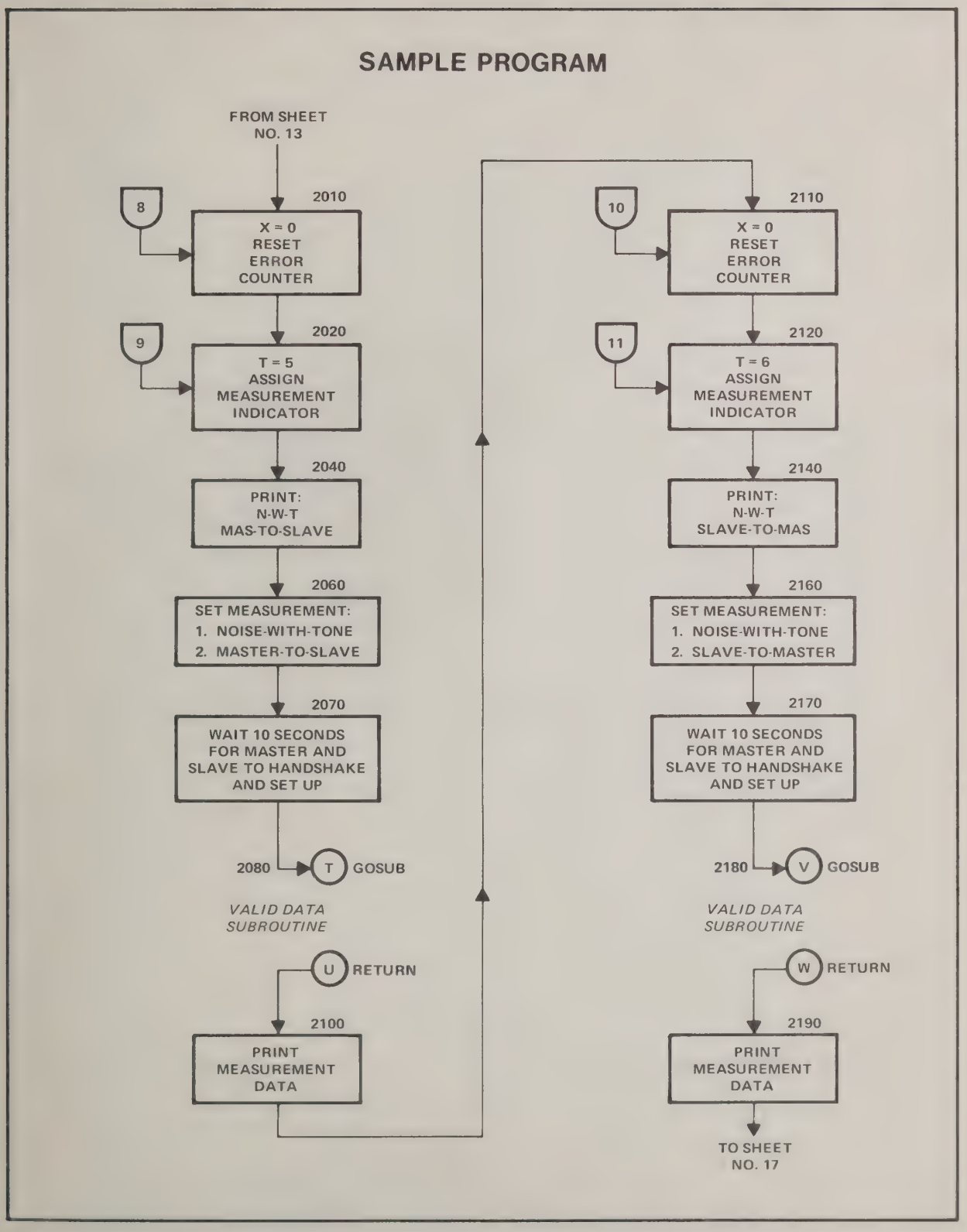

Figure 3-4. Programming Master-Slave Operation (15 of 35)

SAMPLE PROGRAM

```
2200 X=0
2210 T=7
2220 OUTPUT (15,310)10,10
2230 PRINT "SIGNAL-TO-NOISE TEST, MASTER-TO-SLAVE DIRECTION"
2240 PRINT
2250 CMD "?U*","R1M4E"
2260 WAIT 10000
2270 GOSUB 560
2280 FORMAT 4X,F1000.0,1X,"DB AT",1X,F1000.0,1X,"HZ"
2290 OUTPUT (15,2280)A,B
2300 X=0
2310 T=8
2320 OUTPUT (15,310)10,10
2330 PRINT "SIGNAL-TO-NOISE TEST, SLAVE-TO-MASTER DIRECTION"
2340 PRINT
2350 CMD "?U*","R2M4E"
2360 WAIT 10000
2370 GOSUB 560
2380 OUTPUT (15,2280)A,B
```

Figure 3-4. Programming Master-Slave Operation (16 of 35)

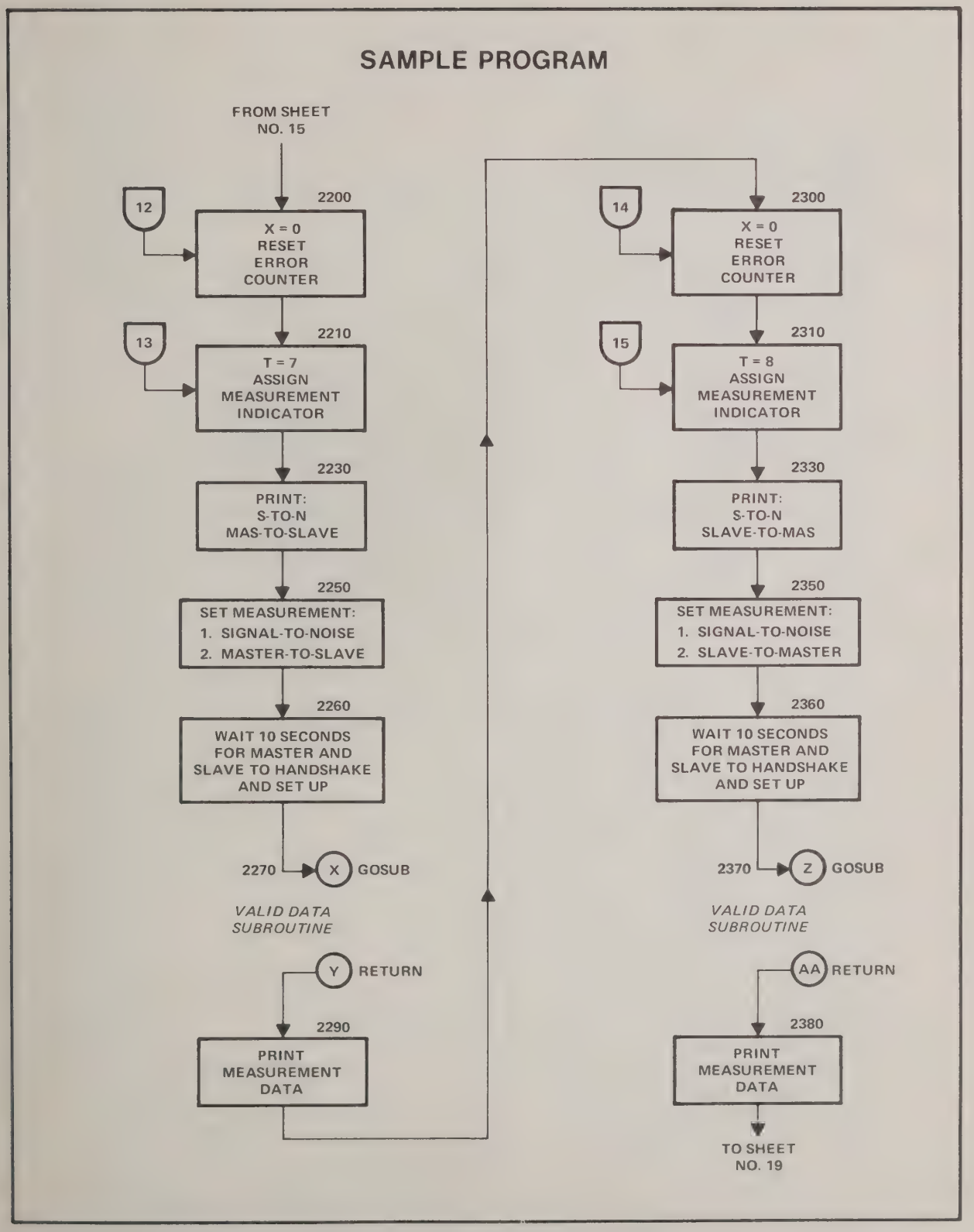

Figure 3-4. Programming Master-Slave Operation (17 of 35)

SAMPLE PROGRAM

```
2390 X=0
2400 T=9
2410 OUTPUT (15,310)10,10
2420 PRINT "IMPULSE NOISE TEST, MASTER-TO-SLAVE DIRECTION"
2430 PRINT
2440 CMD "?U*","R1M5P0E"
2450 WAIT 10000
2460 CMD "?U*","I1E"
2470 WAIT 30000
2480 WAIT 30000
2490 WAIT 30000
2500 WAIT 30000
2510 WAIT 30000
2520 WAIT 30000
2530 WAIT 30000
2540 WAIT 30000
2550 WAIT 30000
2560 WAIT 30000
2570 WAIT 30000
2580 WAIT 30000
2590 GOSUB 560
2600 FORMAT 4X,F1000.0,1X,"COUNTS IN ",F MINUTES"
2610 OUTPUT (15,2600)T
2620 X=0
2630 T=10
2640 OUTPUT (15,310)10,10
2650 PRINT "IMPULSE NOISE TEST, SLAVE-TO-MASTER DIRECTION"
2660 PRINT
2670 CMD "?U*","R2M5P0E"
2680 WAIT 10000
2690 CMD "?U*","I1E"
2700 WAIT 30000
2710 WAIT 30000
2720 WAIT 30000
2730 WAIT 30000
2740 WAIT 30000
2750 WAIT 30000
2760 WAIT 30000
2770 WAIT 30000
2780 WAIT 30000
2790 WAIT 30000
2800 WAIT 30000
2810 WAIT 30000
2820 GOSUB 560
2830 OUTPUT (15,2600)B
```

Figure 3-4. Programming Master-Slave Operation (18 of 35)

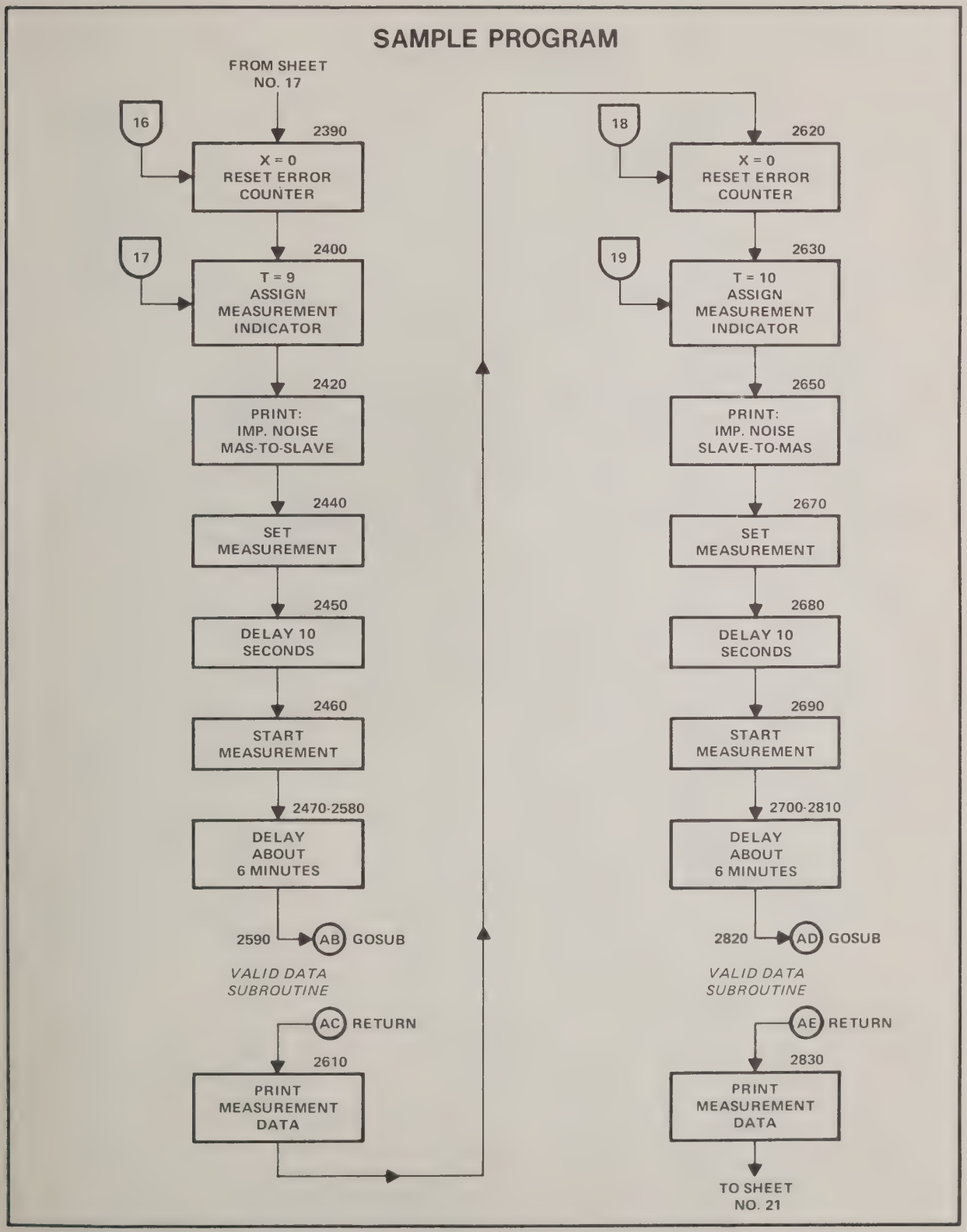

Figure 3-4. Programming Master-Slave Operation (19 of 35)

SAMPLE PROGRAM

```
2840 X=0
2850 T=11
2860 OUTPUT (15,310)10,10
2870 PRINT "ENVELOPE DELAY TEST, MASTER-TO-SLAVE DIRECTION"
2880 PRINT
2890 CMD "?U*","R1M6F1804E"
2900 WAIT 10000
2910 CMD "?U*","Z1E"
2920 WAIT 500
2930 GOSUB 3100
2940 GOSUB 3350
2950 X=0
2960 T=12
2970 OUTPUT (15,310)10,10
2980 PRINT "ENVELOPE DELAY TEST, SLAVE-TO-MASTER DIRECTION"
2990 PRINT
3000 CMD "?U*","R2M6F1804E"
3010 WAIT 10000
3020 CMD "?U*","Z1E"
3030 WAIT 500
3040 GOSUB 3100
3050 GOSUB 3350
3060 PRINT
3070 PRINT "END OF TEST"
3080 OUTPUT (15,310)10,10
3090 END
```

Figure 3-4. Programming Master-Slave Operation (20 of 35)

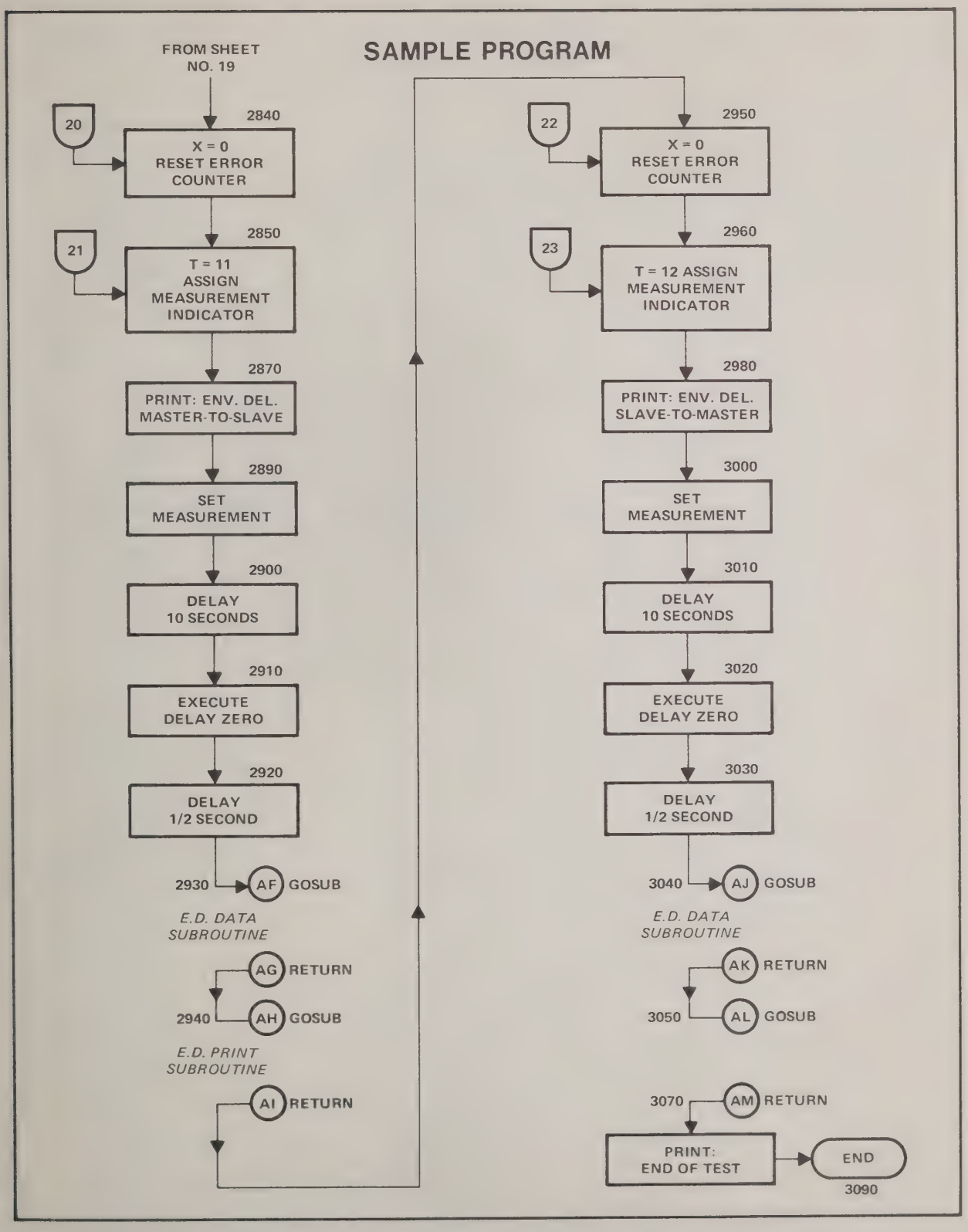

Figure 3-4. Programming Master-Slave Operation (21 of 35)

SAMPLE PROGRAM

```
3100 REM  BEGIN ENV. DEL. DATA SUBROUTINE
3110 J=K=1
3120 DIM D[38,2]
3130 GOSUB 560
3140 U=9999
3150 REM  U ASSUMES VALUE OF MAX POSSIBLE DELAY
3160 FOR N=204 TO 3904 STEP 100
3170 IF N=2504 OR N=2604 OR N=2704 THEN 3290
3180 CMD "?U*"
3190 FORMAT "F",F1000.0,"E"
3200 OUTPUT (13,3190)N
3210 WAIT 2000
3220 GOSUB 560
3230 IF B >= (N+10) OR B <= (N-10) THEN 730
3240 IF A<U THEN 3320
3250 D[J,K]=A
3260 K=2
3270 D[J,K]=B
3280 K=1
3290 J=J+1
3300 NEXT N
3310 RETURN
3320 U=A
3330 V=B
3340 GOTO 3250
```

Figure 3-4. Programming Master-Slave Operation (22 of 35)

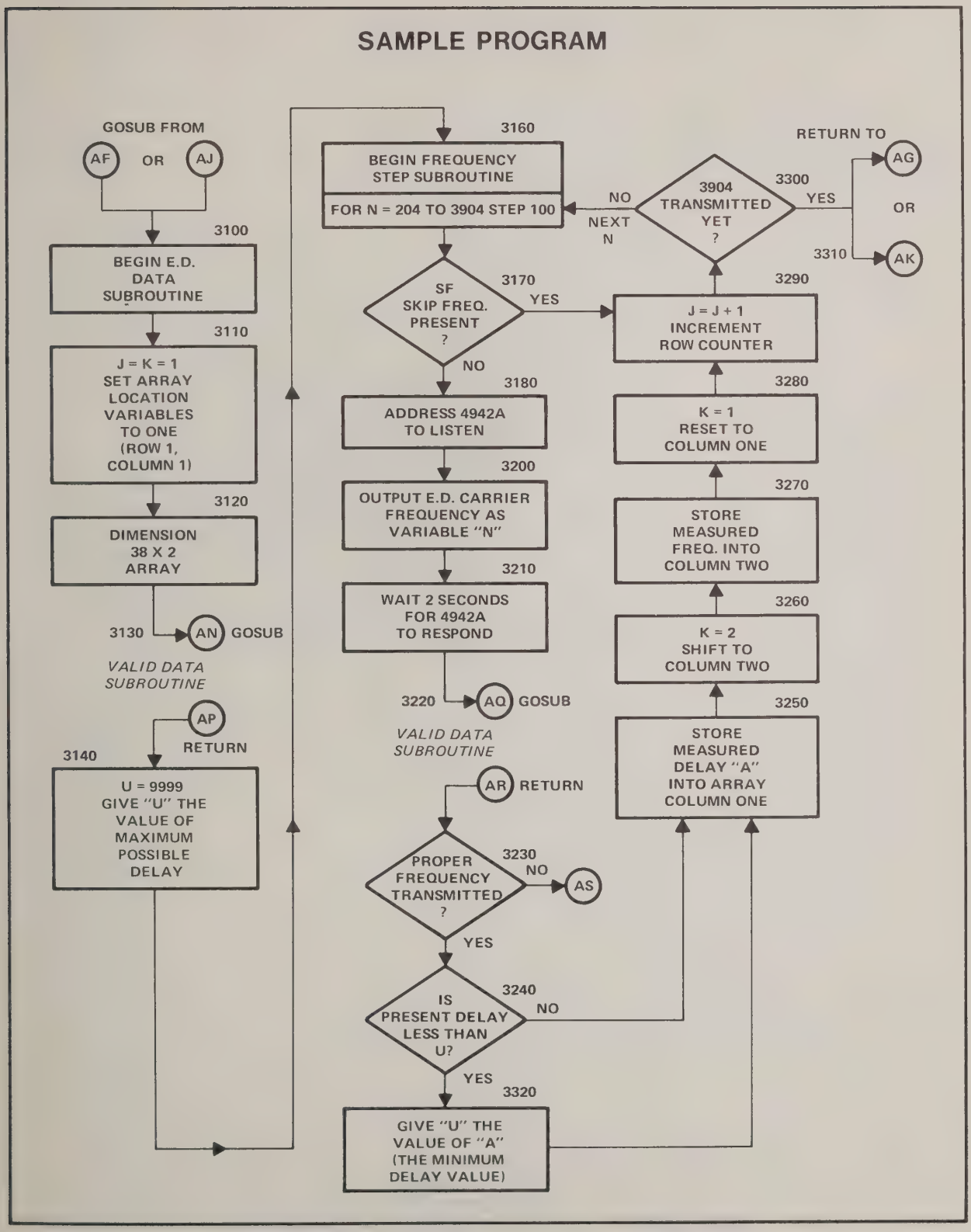

Figure 3-4. Programming Master-Slave Operation (23 of 35)

SAMPLE PROGRAM

```
3350 REM  BEGIN EN . DEL. PRINT SUBROUTINE
3360 IF U <= 0 THEN 3480
3370 IF U>0 THEN 3480
3380 FOR J=1 TO 38
3390 IF J=24 OR J=25 OR J=26 THEN 3460
3400 K=1
3410 A=D[J,K]+ABSU
3420 K=2
3430 B=D[J,K]
3440 FORMAT 4X,F1000.0,1X,"MICRO SEC AT",1X,F1000.0,1X,"HZ"
3450 OUTPUT (15,3440)A,B
3460 NEXT J
3470 RETURN
3480 FOR J=1 TO 38
3490 IF J=24 OR J=25 OR J=26 THEN 3550
3500 K=1
3510 A=D[J,K]-U
3520 K=2
3530 B=D[J,K]
3540 OUTPUT (15,3440)A,B
3550 NEXT J
3560 RETURN
```

Figure 3-4. Programming Master-Slave Operation (24 of 35)

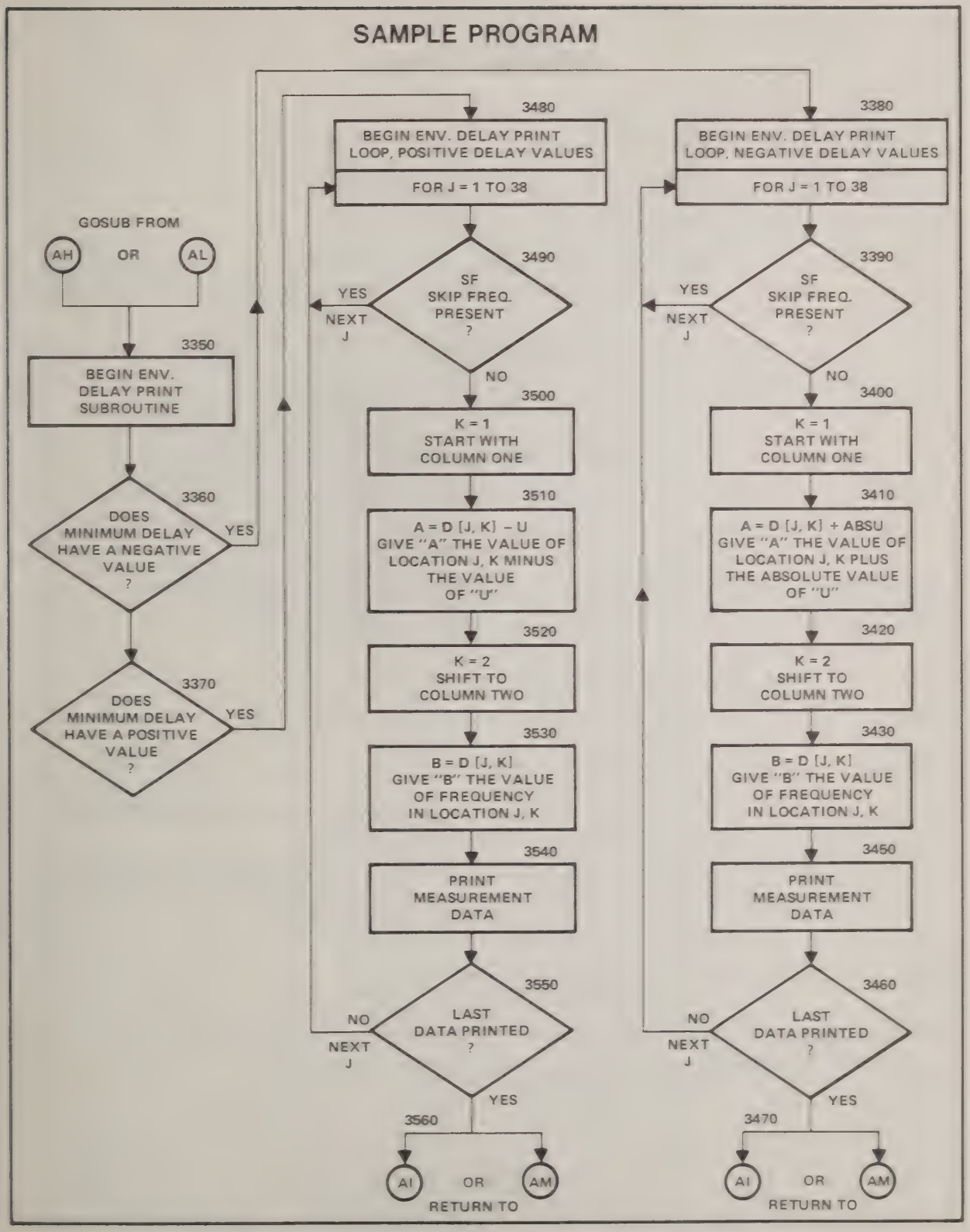

Figure 3-4. Programming Master-Slave Operation (25 of 35)

SAMPLE PROGRAM

LINE NO.	EXPLANATION
10-120	Remarks.
130	Set variables to zero.
140	Assign measurement indicator (T=1 is Level & Frequency, Master-to-Slave direction). Also, if T=1 measurement fails 1 or 2 times, then program execution is again attempted here (1).
160	Print measurement header.
180-200	Set bus to remote.
210	Address 4942A to listen to remote condition.
220	Wait 1/2 second for 4942A to react to remote enable.
230	Set measurement in 4942A.
240	Wait 10 seconds for master and slave to handshake, and for both to set up.
250	Go to valid data detection subroutine.
260	Level zero the slave unit.
270	Wait 2 seconds for slave to zero.
280	Go to frequency step subroutine.
290	Reset error counter to zero for execution of new measurement. Also, if T=1 measurement fails 3 times, then program execution continues here (2).
300	Assign measurement indicator (T=2 is L & F, Slave-to-Master). Also, if T=2 measurement fails 1 or 2 times, then program execution is again attempted here (3).
330	Print measurement header.
350	Set measurement in 4942A.
360	Wait 10 seconds for master and slave to handshake, and for both to set up.
370	Go to valid data detection subroutine.
380	Level zero the master unit.
390	Wait 2 seconds for master to zero.

Figure 3-4. Programming Master-Slave Operation (26 of 35)

SAMPLE PROGRAM

LINE NO.	EXPLANATION
400	Go to frequency step subroutine.
410	Jump over valid data, frequency step, and error counter subroutines to execute next measurement.
420-550	Frequency step subroutine.
430	Start of FOR-NEXT loop to step frequency in 200 Hz steps.
440	Check for the presence of an SF skip frequency. If present, then do not transmit it and go to next frequency.
470	Output transmit frequency to 4942A as variable "N".
480	Wait 2 seconds for master and slave to handshake.
490	Go to valid data subroutine.
500	Check to see if the proper frequency was transmitted (as measured by the 4942A). Allow a tolerance of plus or minus 10 Hz. If not, then jump to print the error condition, and possibly try again the measurement.
530	Output to printer the measured data in a format with measurement units.
540	End of frequency step loop.
550	Return to main program.
560-840	Valid data subroutine.
600	Enter into calculator the measurement data from 4942A.
610	Check for presence of a non-decimal point type error. Error code present as 99XX number. 9910 is an H-10 error. If present, go to print the code.
620	Check for presence of a decimal point type error. Error code present as 9X.X number 91.0 is an H-10 error. If present, go to print the code.
640	Check for presence of an out of range condition (either overrange or underrange). It is not possible to reliably differentiate between the two possible conditions using HP-IB, so one statement is used to detect if any possible condition is present.
660	Return to main program.
670-710	Non-decimal point error code print.

Figure 3-4. Programming Master-Slave Operation (27 of 35)

SAMPLE PROGRAM

LINE NO.	EXPLANATION
720-750	Decimal point error code print.
760-780	Out of range print.
790-840	Frequency error print.
850-1810	Error counter subroutine. The first objective of the counter is to identify the measurement. Steps 850 through 970 do this. Then after the current measurement is identified, the program jumps to the particular counter for that measurement. If T = 3, then line 1120 is accessed. The variable "X" is incremented by one at line 1130. If this line has been accessed three times, then line 1140 jumps program execution to the next measurement (T = 4), and at line 1920 resets "X" to zero. If "X" does not equal three, then line 1180 is accessed. This line returns program execution to T = 3 at line 1830. Note that in this case the variable "X" is not reset to zero, but allowed to retain its value as incremented by line 1130. Line 1160 provides a two second delay before reattempting the T = 3 measurement.
1820-1910	C-message noise, master-to-slave direction.
1920-2000	C-message noise, slave-to-master direction.
2010-2100	Noise-with-tone, master-to-slave direction.
2110-2190	Noise-with-tone, slave-to-master direction.
2200-2290	Signal-to-noise, master-to-slave direction.
2300-2380	Signal-to-noise, slave-to-master direction.
2390-2610	Impulse noise, master-to-slave direction.
2460	This command actually starts the measurement, and must occur after the 10 second setup time.
2470-2580	An approximate 6 minute delay to allow the 5-minute measurement. If a reading is attempted before the end of the measurement, the 4942A will terminate its timing sequence. For longer measurements, i.e., 15 minutes, a serial poll routine is recommended.
2620-2830	Impulse noise, slave-to-master direction.
2840-2940	Envelope delay, master-to-slave direction.
2890	Sets the envelope delay measurement and causes an initial carrier frequency of 1804 Hz.

Figure 3-4. Programming Master-Slave Operation (28 of 35)

SAMPLE PROGRAM

LINE NO.	EXPLANATION
2910	Delay zeros the measurement loop at 1804 Hz. This command does not cause all future envelope delay measurements to be referenced to 1804 Hz. This will be explained later. However, this step tends to minimize delay values as first measured by the 4942A. This helps to prevent measured envelope delay values which would appear in the range of error code numbers.
2920	Wait 1/2 second to allow delay zero to complete.
2930	Goes to envelope delay data subroutine to measure delay values, store them, and determine the minimum delay frequency.
2940	Goes to envelope delay print subroutine.
2950-3050	Envelope delay, master-to-slave direction.
3090	End of main program.
3100-3340	Envelope delay data gathering subroutine.
3110	Set array location variables to one, i.e., row 1, column 1.
3120	Dimension a 38-by-2 array to allow space for all envelope delay measurement data.
3130	Go to valid data subroutine to enter data and check for presence of any possible errors.
3140	Set "U" to the value of maximum possible delay of 9999 micro seconds. This assures that the minimum delay value will be found by line 3240.
3160	Start of FOR-NEXT loop to step the variable carrier frequency.
3170	Check for the presence of SF skip frequencies. If present, then jump to line 3290 to increment row number and access NEXT N statement.
3200	Output carrier frequency as variable "N"
3210	Wait 2 seconds for 4942A to respond.
3220	Go to valid data subroutine to enter measurement data.
3230	Check to see if the proper frequency was transmitted (as measured by the 4942A). Allow a tolerance of plus or minus 10 Hz. If not, then jump to print the error condition, and possibly try again the measurement.
3240	Check to see if the just measured delay value is less than the current value of "U". If so, then go to line 3320 and give "U" this new value.

Figure 3-4. Programming Master-Slave Operation (29 of 35)

SAMPLE PROGRAM

LINE NO.	EXPLANATION
3250	Assign to row J, column 1, the value of measured delay.
3260	Step to column 2.
3270	Assign to row J, column 2, the value of measured frequency.
3280	Step back to column 1.
3290	Increment to next row.
3300	End of FOR-NEXT loop. Go to next "N".
3310	At end of FOR-NEXT loop, return to main program.
3320	Assigns "U" the value of minimum delay.
3330	Assigns "V" the frequency of minimum delay. "V" not used in main program. Used for software debug.
3340	Go back to continue subroutine.
3350-3560	Envelope delay print subroutine.
3360	Decide if "U" is a negative number. If so, then go to 3380.
3370	Decide if "U" is a positive number. If so, then go to 3480.
3380-3460	FOR-NEXT loop to print delay values with a negative "U".
3390	Check for the rows where SF skip has caused empty locations. If an SF skip location is specified (J=24, 25, or 26), then do not try to print this location. Jump to NEXT J statement.
3400	Select column 1.
3410	Assign "A" the value of row J, column 1, plus the absolute value of "U". This procedure assumes "U" is a negative number, and adds the absolute value of "U" to the array location before printing it.
3420	Step to column 2.
3430	Assign "B" the value of row J, column 2.
3450	Print "A" and "B".
3460	End of FOR-NEXT loop.

Figure 3-4. Programming Master-Slave Operation (30 of 35)

SAMPLE PROGRAM

LINE NO.	EXPLANATION
3470	Return to main program.
3480-3550	FOR-NEXT loop for positive "U".
3510	Assign "A" the value of row J, column 1, minus the value of "U". This procedure assumes "U" is a positive number, and subtracts the value of "U" from the array location before printing it.

NOTE: The above envelope delay print subroutine causes an effective delay zero at the frequency of minimum delay. This frequency may be any of the frequencies specified in the envelope delay data subroutine.

Figure 3-4. Programming Master-Slave Operation (31 of 35)

SAMPLE PROGRAM

SAMPLE PRINTOUT

```
LEVEL & FREQUENCY TEST, MASTER-TO-SLAVE DIRECTION

     0 DB AT 204 HZ
     0 DB AT 404 HZ
     0 DB AT 604 HZ
     0 DB AT 804 HZ
     0 DB AT 1004 HZ
     0 DB AT 1204 HZ
     0 DB AT 1404 HZ
     0 DB AT 1604 HZ
     0 DB AT 1804 HZ
     0 DB AT 2004 HZ
     0 DB AT 2204 HZ
     0 DB AT 2404 HZ
     0 DB AT 2804 HZ
     0 DB AT 3004 HZ
     0 DB AT 3204 HZ
     0 DB AT 3404 HZ
     0 DB AT 3604 HZ
     0 DB AT 3804 HZ


LEVEL & FREQUENCY TEST, SLAVE-TO-MASTER DIRECTION

     0 DB AT 204 HZ
     0 DB AT 404 HZ
     0 DB AT 603 HZ
     0 DB AT 804 HZ
     0 DB AT 1004 HZ
     0 DB AT 1204 HZ
     0 DB AT 1404 HZ
     0 DB AT 1604 HZ
     0 DB AT 1804 HZ
     0 DB AT 2004 HZ
     0 DB AT 2204 HZ
     0 DB AT 2404 HZ
     0 DB AT 2804 HZ
     0 DB AT 3004 HZ
     0 DB AT 3204 HZ
     0 DB AT 3404 HZ
     0 DB AT 3604 HZ
     0 DB AT 3804 HZ
```

Figure 3-4. Programming Master-Slave Operation (32 of 35)

SAMPLE PROGRAM

SAMPLE PRINTOUT

```
C-MESSAGE NOISE TEST, MASTER-TO-SLAVE DIRECTION
    ERROR CODE H-10 PRESENT

C-MESSAGE NOISE TEST, MASTER-TO-SLAVE DIRECTION
    ERROR CODE H-10 PRESENT

C-MESSAGE NOISE TEST, MASTER-TO-SLAVE DIRECTION
    ERROR CODE H-10 PRESENT

C-MESSAGE NOISE TEST, SLAVE-TO-MASTER DIRECTION
OUT OF RANGE CONDITION PRESENT

C-MESSAGE NOISE TEST, SLAVE-TO-MASTER DIRECTION
OUT OF RANGE CONDITION PRESENT

C-MESSAGE NOISE TEST, SLAVE-TO-MASTER DIRECTION
OUT OF RANGE CONDITION PRESENT

NOISE-WITH-TONE TEST, MASTER-TO-SLAVE DIRECTION
    23 DBRNC

NOISE-WITH-TONE TEST, SLAVE-TO-MASTER DIRECTION
    27 DBRNC
```

Figure 3-4. Programming Master-Slave Operation (33 of 35)

SAMPLE PROGRAM

SAMPLE PRINTOUT

SIGNAL-TO-NOISE TEST: MASTER-TO-SLAVE DIRECTION

65 DB AT 1004 HZ

SIGNAL-TO-NOISE TEST: SLAVE-TO-MASTER DIRECTION

64 DB AT 1004 HZ

IMPULSE NOISE TEST: MASTER-TO-SLAVE DIRECTION

2029 COUNTS IN 5 MINUTES

IMPULSE NOISE TEST: SLAVE-TO-MASTER DIRECTION

2304 COUNTS IN 5 MINUTES

Figure 3-4. Programming Master-Slave Operation (34 of 35)

SAMPLE PROGRAM

SAMPLE PRINTOUT

```
ENVELOPE DELAY TEST, MASTER-TO-SLAVE DIRECTION

    48 MICRO SEC AT 204 HZ
    12 MICRO SEC AT 304 HZ
    7 MICRO SEC AT 404 HZ
    5 MICRO SEC AT 504 HZ
    3 MICRO SEC AT 604 HZ
    3 MICRO SEC AT 704 HZ
    2 MICRO SEC AT 804 HZ
    2 MICRO SEC AT 904 HZ
    1 MICRO SEC AT 1004 HZ
    1 MICRO SEC AT 1104 HZ
    1 MICRO SEC AT 1204 HZ
    1 MICRO SEC AT 1304 HZ
    1 MICRO SEC AT 1404 HZ
    1 MICRO SEC AT 1504 HZ
    1 MICRO SEC AT 1604 HZ
    1 MICRO SEC AT 1704 HZ
    1 MICRO SEC AT 1804 HZ
    1 MICRO SEC AT 1904 HZ
    1 MICRO SEC AT 2004 HZ
    0 MICRO SEC AT 2104 HZ
    1 MICRO SEC AT 2204 HZ
    1 MICRO SEC AT 2304 HZ
    1 MICRO SEC AT 2404 HZ
    1 MICRO SEC AT 2804 HZ
    1 MICRO SEC AT 2904 HZ
    1 MICRO SEC AT 3004 HZ
    2 MICRO SEC AT 3104 HZ
    1 MICRO SEC AT 3204 HZ
    2 MICRO SEC AT 3304 HZ
    2 MICRO SEC AT 3404 HZ
    2 MICRO SEC AT 3504 HZ
    2 MICRO SEC AT 3604 HZ
    2 MICRO SEC AT 3704 HZ
    2 MICRO SEC AT 3804 HZ
    2 MICRO SEC AT 3904 HZ


ENVELOPE DELAY TEST, SLAVE-TO-MASTER DIRECTION

    52 MICRO SEC AT 204 HZ
    22 MICRO SEC AT 304 HZ
    13 MICRO SEC AT 404 HZ
    13 MICRO SEC AT 504 HZ
    13 MICRO SEC AT 604 HZ
```

Figure 3-4. Programming Master-Slave Operation (35 of 35)

SAMPLE PROGRAM EXCERPT

PURPOSE: Start a measurement (IMPULSE NOISE) and then free the calculator for other duties. Have the calculator occasionally check to see if the 4942A has finished the measurement. Only if the measurement is finished will the measurement data be requested by the calculator.

TECHNIQUE: Use the service request (SRQ) function to alert the calculator when the measurement is finished. Use the serial poll procedure (SPE & SPD) to determine if the 4942A has requested service and if it is ready to output data.

Figure 3-5. Programming Serial Poll (1 of 4)

SAMPLE PROGRAM EXCERPT

```
                                    •
                                    •
                                    •
110 A=B=Q=S=T=0
120 CMD "?U*","R0M5P0D101E"
130 WAIT 2000
140 CMD "?U*","I1E"
150 GOTO 540
160 FOR S=1 TO 10
170 REM   S GIVES 10 TRIES (TO GET Q=80) FOR TOTAL OF 20 SECONDS
180 CMD "?U"
190 FORMAT 5B
200 OUTPUT (13,190)256,95,53,24,512;
210 REM   LAST 3 LINES EXECUTE SPE
220 CMD "J"
230 Q=RBYTE13
240 REM LAST 2 LINES READ THE STATUS CODE FROM 4942A
250 CMD "?U"
260 FORMAT 3B
270 OUTPUT (13,260)256,25,512;
280 REM   LAST 3 STEPS EXECUTE SPD
290 IF Q=80 THEN 340
300 REM   IF Q=80 THEN 4942A REQUESTING SERVICE
310 WAIT 2000
320 IF S=10 THEN 630
330 NEXT S
340 CMD "?J5"
350 FORMAT 2F7.0
360 ENTER (13,350)A,B
370 PRINT "IMPULSE NOISE COUNT"
380 PRINT "  ";B;"COUNTS"
390 REM   PROGRAM EXECUTION CONTINUES HERE
                                    •
                                    •
                                    •
540 FOR T=1 TO 14
550 REM   T GIVES 14 TRIES TO GET SRQ FOR TOTAL OF 7 MINUTES
560 DISP "IMPULSE NOISE TEST IN PROGRESS"
570 WAIT 30000
580 CMD "?U"
590 IF STAT13 <= 1 THEN 160
600 REM   LAST 2 LINES CHECK FOR SRQ
610 IF T=14 THEN 630
620 NEXT T
630 PRINT "SERVICE REQUEST FAILED"
640 GOTO 390
                                    •
                                    •
                                    •
```

Figure 3-5. Programming Serial Poll (2 of 4)

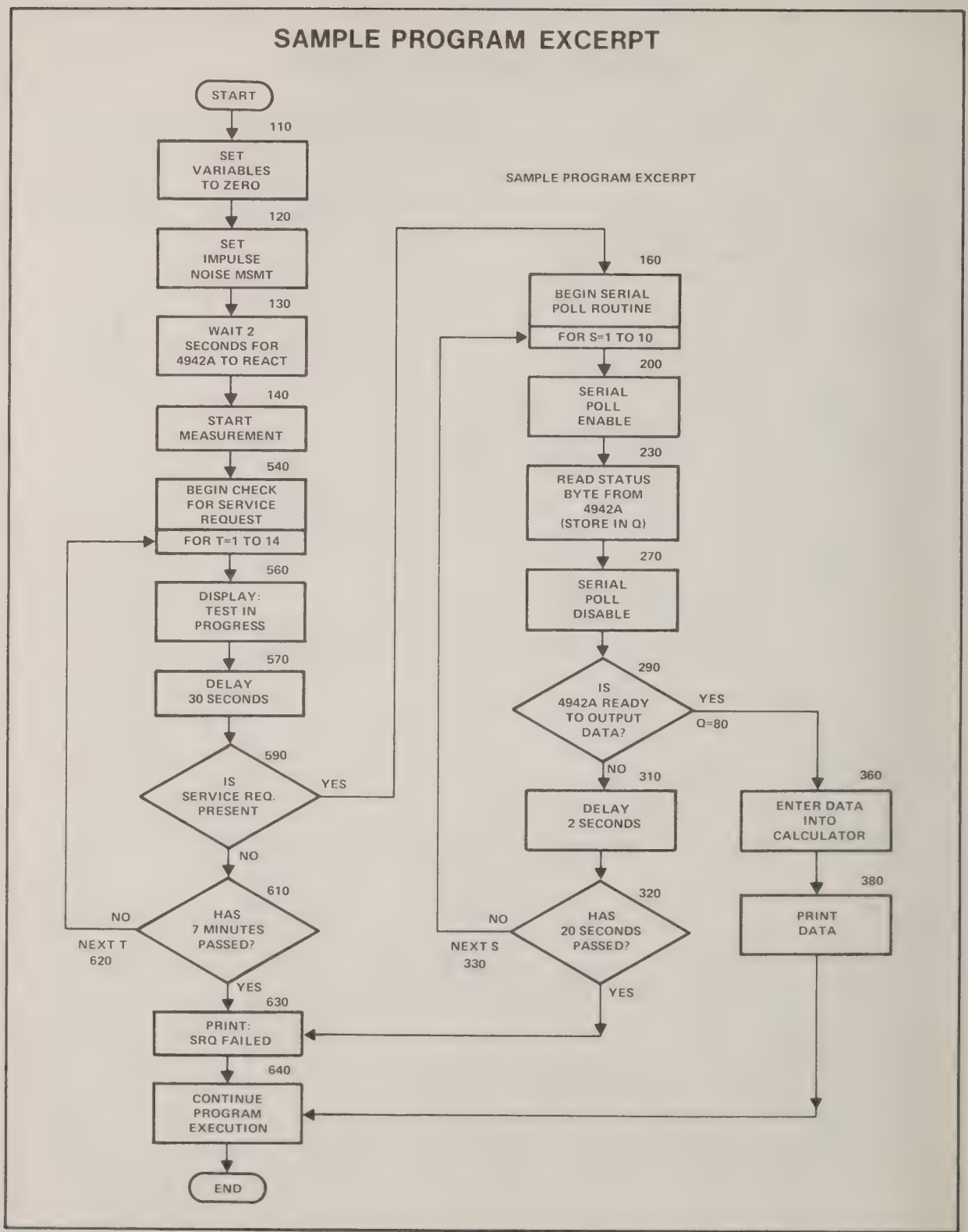

Figure 3-5. Programming Serial Poll (3 of 4)

SAMPLE PROGRAM EXCERPT

LINE NO.	EXPLANATION
110	Set variables to zero.
120	Set measurement in 4942A.
130	Wait 2 seconds for 4942A to digest instructions.
140	Start the measurement.
150	Calculator leaves 4942A and takes care of other duties.
160-330	Routine to execute serial poll.
180-200	Executes serial poll.
220-230	Polls 4942A for its status byte.
250-270	Executes serial poll disable.
290	Checks to see if 4942A has requested service. If yes, jump to read data.
310	Delay 2 seconds before rechecking 4942A for status byte.
320	If status byte "80" not returned after 20 seconds (S = 10), then jump out of serial poll routine.
330	Try again.
340-360	Read measurement data from 4942A.
370-380	Print measurement data.
390	Continue program execution.
540-620	Routine to check for service request.
580-590	Checks for presence of service request.
610	If measurement not finished after 7 minutes (T = 14), then jump out of routine.
620	Try again.
630-640	Print SRQ failed and jump to continue program execution.

Figure 3-5. Programming Serial Poll (4 of 4)

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3-35. OPTIONAL VERIFICATION PROGRAMS

3-36. The series of programs listed below provide for operational verification of the HP-IB remote interface in the 4942A. These programs may be reviewed as operating examples, or simply used as operational checks. The 4942A user may wish to pick and choose program segments according to need, or possibly store the continuous program on a cassette.

Figure No.	Exercises	Line Numbers
3-8.	Self Check	10-470
3-9.	Device Clear (DCL) Test	480-810
3-10.	Interface Clear (IFC) Test	820-1130
3-11.	Go to Local (GTL) Test	1140-1460
3-12.	Serial Poll Test (SRQ, SPE, & SPD)	1470-2050
3-13.	Master-Slave Operation	2060-2720

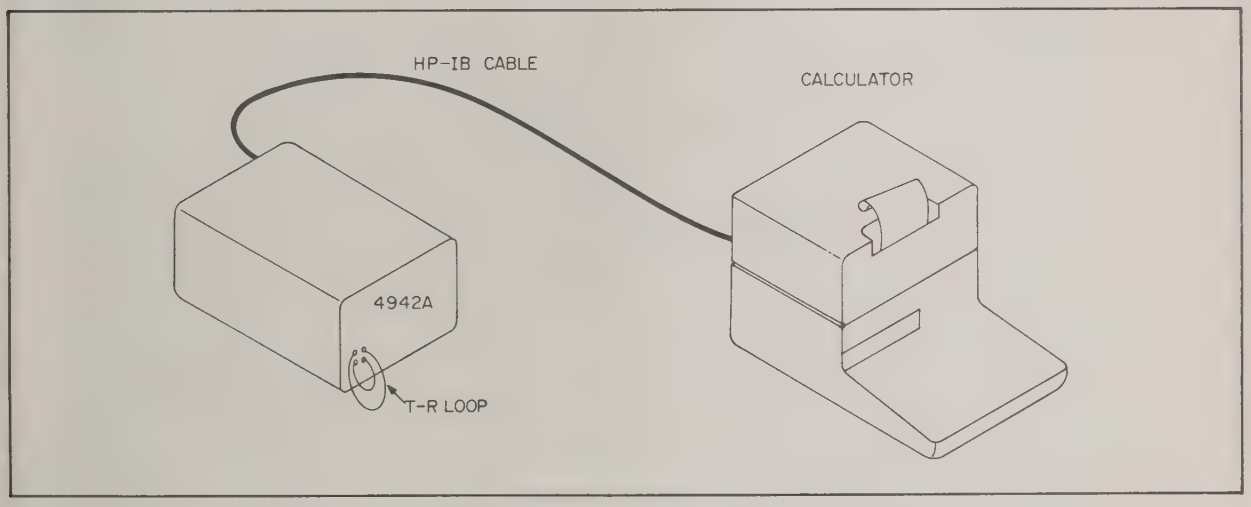


Figure 3-6. Optional Verification Program Test Setup, Normal Mode

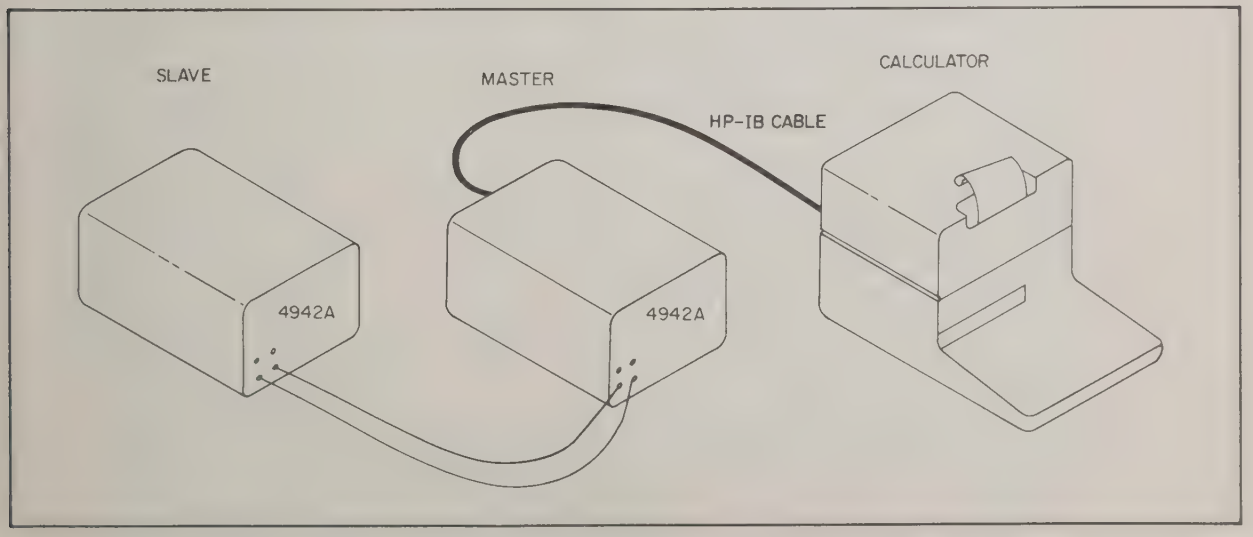


Figure 3-7. Optional Verification Program Test Setup, Master-Slave Mode

OPTIONAL VERIFICATION PROGRAM

```
10 A=B=0
20 PRINT "THIS PROGRAM RUNS THE 4942A THROUGH SELF CHECK"
30 PRINT
40 PRINT "USING THE HP-IB I/O INTERFACE"
50 PRINT
60 PRINT "SETUP: LOOP T-R, ADJ. LEVEL TO 0.0 DBM"
70 PRINT
80 DISP "MAKE SETUP AND 'CONT EXECUTE'"
90 STOP
100 CMD "?U"
110 FORMAT B
120 OUTPUT (13,110)768;
130 REM LAST 3 LINES SET REN LINE LOW
140 CMD "?U*"
150 WAIT 500
160 REM LAST 2 LINES TELL 4942A TO LISTEN TO REN
170 REM 4942A NOW SET TO REMOTE
180 CMD "?U*","S1E"
190 REM 4942A TOLD TO START SELF CHECK
200 WAIT 30000
210 WAIT 30000
220 WAIT 10000
230 CMD "?J5"
240 REM 4942A NOW TALKS TO 9830A
250 FORMAT 2F7.0
260 ENTER (13,250)A,B
270 IF A=9950 THEN 320
280 REM IF A=9950 THEN SELF CHECK PASSED
290 PRINT
300 PRINT
310 GOTO 380
320 PRINT
330 PRINT
340 PRINT "PASSED SELF CHECK"
350 PRINT
360 PRINT
370 GOTO 440
380 PRINT "H-CODES NOW APPEAR ON 4942A DISPLAY"
390 PRINT
400 PRINT "SELF CHECK FAILED"
410 PRINT
420 PRINT
430 WAIT 30000
440 CMD "?U*","S0E"
450 REM WA6AWA 11 JUNE 76
460 DISP "'CONT EXECUTE' FOR DCL TEST"
470 STOP
```

Figure 3-8. Self Check (1 of 3)

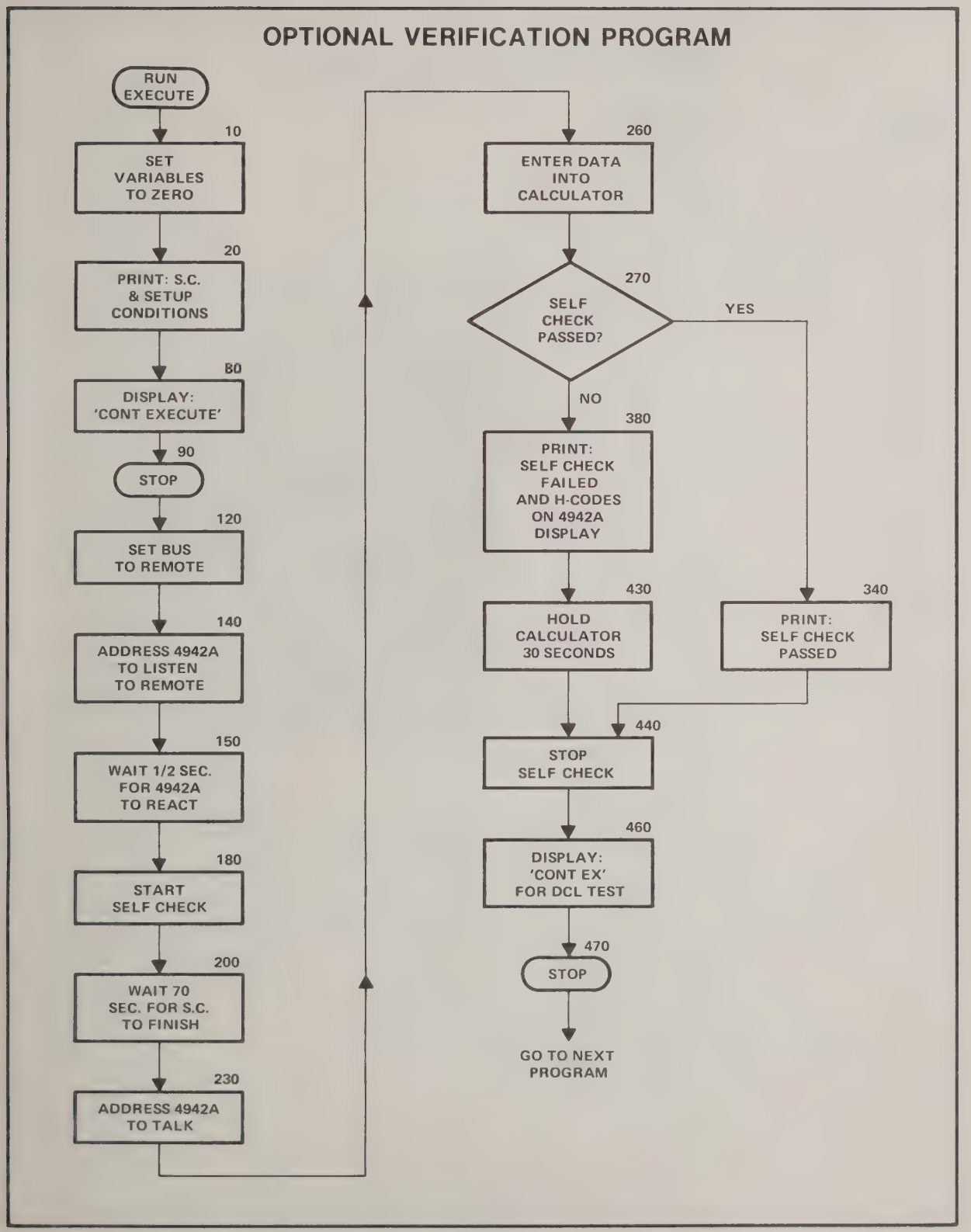


Figure 3-8. Self Check (2 of 3)

OPTIONAL VERIFICATION PROGRAM

LINE NO.	EXPLANATION
10	Set variables to zero.
20-70	Print measurement header.
80	Display instructions to continue.
90	Stop program to allow operator to make setup.
100-120	Set bus to remote.
140	Address 4942A to listen to the remote condition.
150	Wait 1/2 second for 4942A to react.
180	Start self check.
200-220	Wait 70 seconds for self check to finish.
230	Address 4942A to talk.
250-260	Enter data from 4942A into calculator.
270	Decide if self check passed. If left display data equals 9950, then self check passed.
310	Go to print self check failed. If this part of program accessed, then A not equal to 9950.
340	Print self check passed.
370	Go to end self check.
380	Print that H-codes now appear on 4942A display.
400	Print that self check failed.
430	Hold display of H-codes for 30 seconds so operator can view them.
440	Stop self check.
460	Display instructions for continuing to DCL test.
470	Stop program execution

Figure 3-8. Self Check (3 of 3)

OPTIONAL VERIFICATION PROGRAM

```
480 PRINT "SETUP: LOOP T-R, LEV & FREQ, LEV TO 0.0 DBM"
490 PRINT
500 DISP "MAKE SETUP AND 'CONT EXECUTE'."
510 STOP
520 DISP "BEGIN DCL TEST"
530 WAIT 2000
540 A=B=0
550 CMD "?U"
560 FORMAT B
570 OUTPUT (13,560)768;
580 CMD "?U*"
590 WAIT 500
600 REM 4942A NOW SET TO REMOTE
610 CMD "?U*","R0M1D1F20400E"
620 WAIT 2000
630 CMD "?J5"
640 REM 4942A NOW TALKS TO 9830A
650 FORMAT 2F7.0
660 ENTER (13,650)A,B
670 IF B=204 THEN 710
680 PRINT "DEVICE CLEAR TEST FAILED"
690 PRINT
700 GOTO 800
710 CMD "?U"
720 FORMAT 3B
730 OUTPUT (13,720)256,20,512;
740 REM LAST 3 LINES EXECUTE DCL
750 PRINT "THE 4942A SHOULD NOW"
760 PRINT "DISPLAY 1004 RCV HZ"
770 PRINT "IF SO,THEN DCL IS WORKING"
780 PRINT
790 WAIT 2000
800 DISP "'CONT EXECUTE' FOR IFC TEST"
810 STOP
```

Figure 3-9. Device Clear Test (1 of 3)

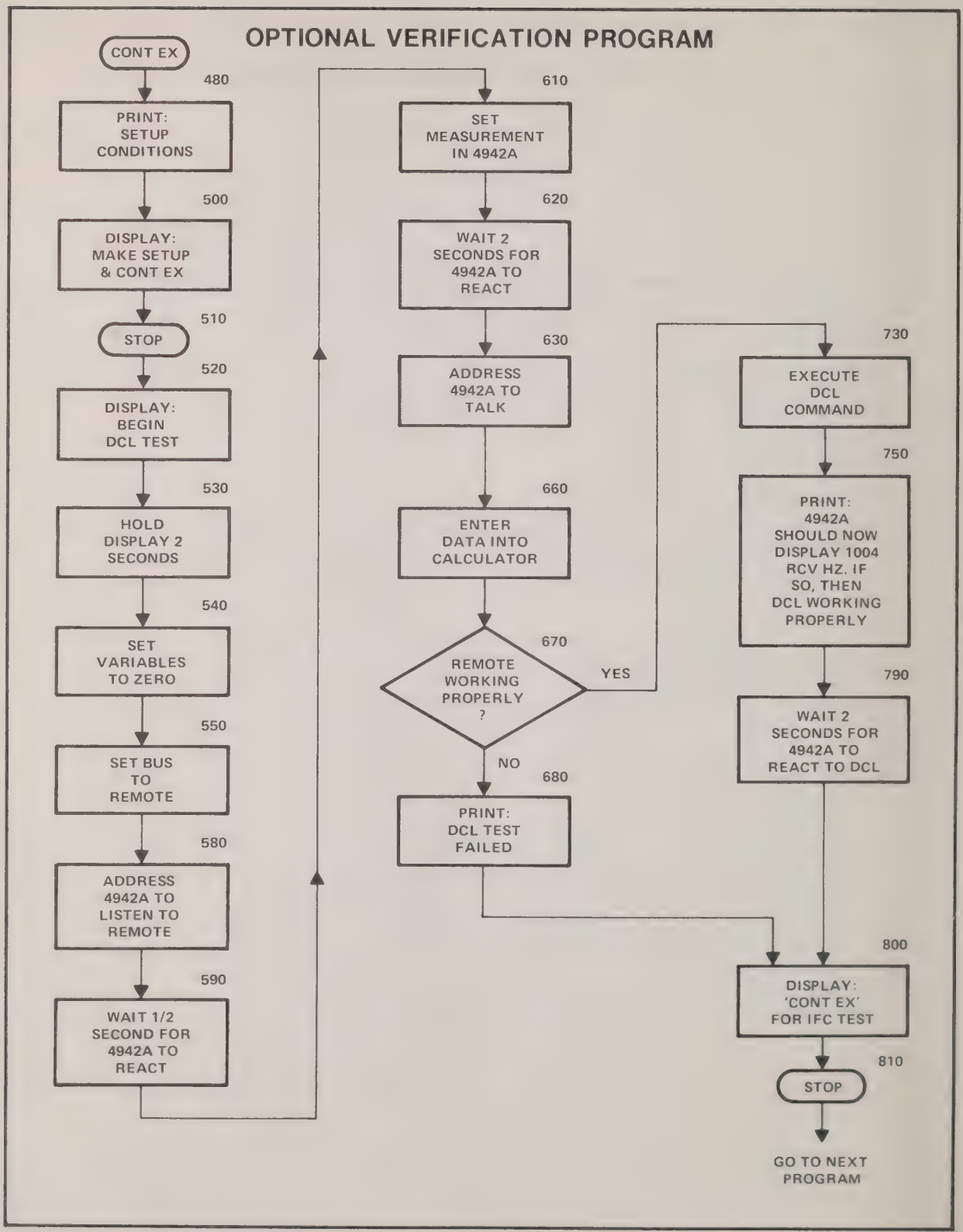


Figure 3-9. Device Clear Test (2 of 3)

OPTIONAL VERIFICATION PROGRAM

LINE NO.	EXPLANATION
480	Print setup conditions.
500	Display instructions to continue program.
510	Stop program to allow operator to make setup.
520	Display begin DCL test.
530	Hold display 2 seconds.
540	Set variables to zero.
550-570	Set bus to remote.
580	Address 4942A to listen to remote.
590	Wait 1/2 second for 4942A to react.
610	Set measurement in 4942A.
620	Wait 2 seconds for 4942A to react.
630	Address 4942A to talk.
650-660	Enter measurement data into calculator.
670	Decide if 4942A is working properly in the remote mode.
680	Print DCL test failed. If this part of program accessed, then B not equal to 204.
700	Go to display instructions for next program.
710-730	Execute DCL.
750-770	Print expected test results.
790	Wait 2 seconds for 4942A to react to DCL.
800	Display instructions to go to next program.
810	End of program.

Figure 3-9. Device Clear Test (3 of 3)

OPTIONAL VERIFICATION PROGRAM

```
820 DISP "BEGIN IFC TEST"
830 WAIT 2000
840 A=B=0
850 CMD "?U"
860 FORMAT B
870 OUTPUT (13;860,768)
880 CMD "?U*"
890 WAIT 500
900 REM 4942A NOW SET TO REMOTE
910 CMD "?U*","R0M1D1F20400E"
920 WAIT 2000
930 CMD "?J5"
940 REM 4942A NOW TALKS TO 9830A
950 FORMAT 2F7.0
960 ENTER (13,950)A,B
970 IF B=204 THEN 1030
980 PRINT "IFC TEST FAILED"
990 PRINT
1000 DISP "'CONT EXECUTE' FOR GTL TEST"
1010 STOP
1020 GOTO 1140
1030 CMD "?U*"
1040 DISP "PRESS 'STOP' AND 'CONT EXECUTE'"
1050 STOP
1060 CMD "U","F3004E"
1070 PRINT
1080 PRINT "THE 4942A SHOULD STILL"
1090 PRINT "DISPLAY 204 HZ"
1100 PRINT "IF SO, THEN IFC IS WORKING"
1110 PRINT
1120 DISP "'CONT EXECUTE' FOR GTL TEST"
1130 STOP
```

Figure 3-10. Interface Clear Test (1 of 3)

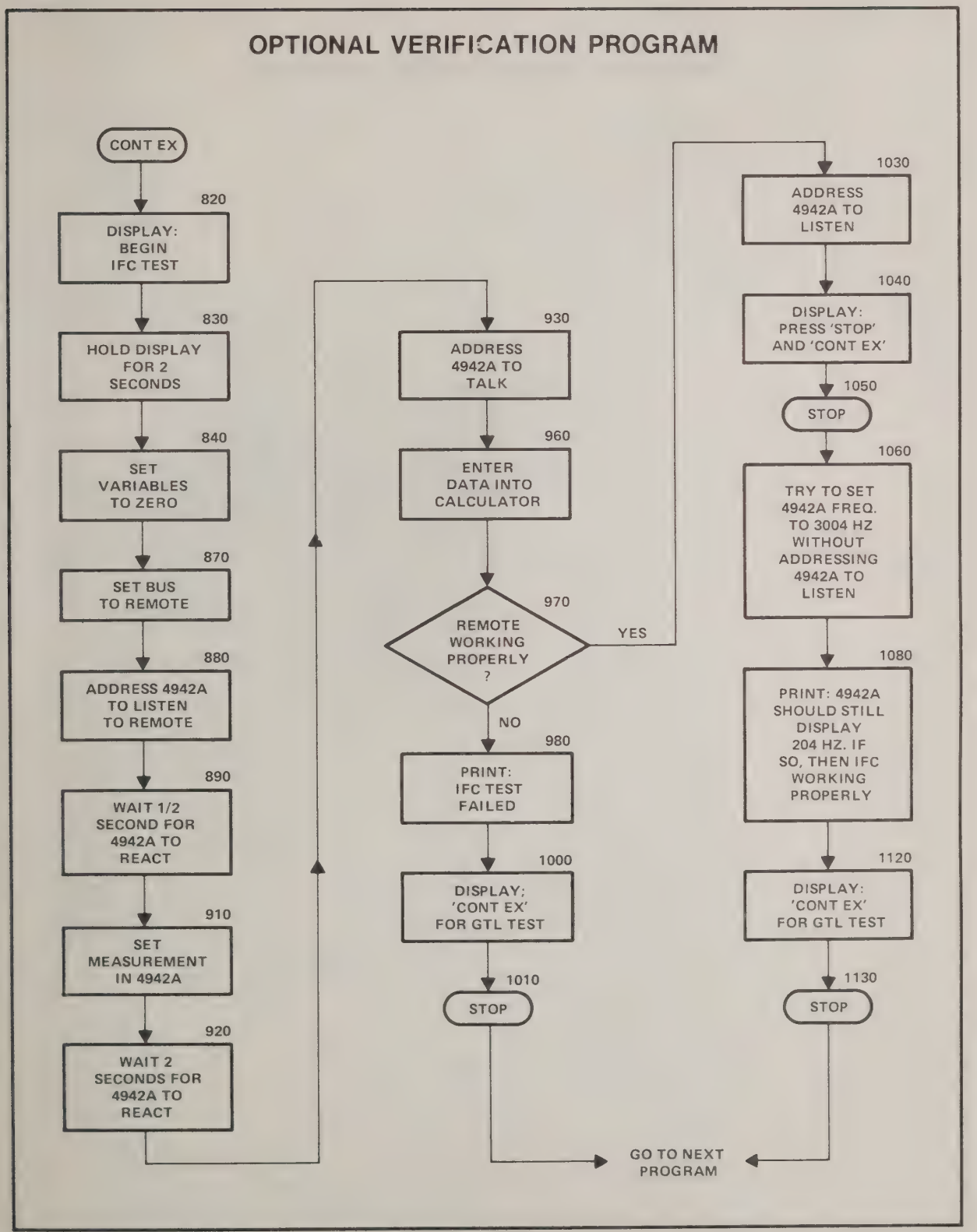


Figure 3-10. Interface Clear Test (2 of 3)

OPTIONAL VERIFICATION PROGRAM

LINE NO.	EXPLANATION
820	Display begin IFC test.
830	Hold display for 2 seconds.
840	Set variables to zero.
850-870	Set bus to remote.
880	Address 4942A to listen to remote.
890	Wait 1/2 second for 4942A to react.
910	Set measurement in 4942A.
920	Wait 2 seconds for 4942A to react.
930	Address 4942A to talk.
950-960	Enter measurement data.
970	Determine if 4942A working properly in remote.
980	Print IFC test failed. If this part of program accessed, then B not equal to 204 Hz.
1000	Display instructions for continuing to next test.
1010	Stop program so operator can view instructions.
1020	Go to next program.
1030	Address 4942A to listen.
1040	Display instructions for executing interface clear.
1050	Stop program so operator can view instructions.
1060	Try to change transmitter frequency without addressing 4942A to listen.
1080-1100	Print expected results.
1120	Display instructions for continuing to next test.
1130	Stop program so operator can view instructions.

Figure 3-10. Interface Clear Test (3 of 3)

OPTIONAL VERIFICATION PROGRAM

```
1140 DISP "BEGIN GTL TEST"
1150 A=B=0
1160 WAIT 2000
1170 CMD "?U"
1180 FORMAT B
1190 OUTPUT (13,1180)768;
1200 CMD "?U*"
1210 WAIT 500
1220 REM 4942A NOW SET TO REMOTE
1230 CMD "?U*","R0M1D1F20400E"
1240 WAIT 2000
1250 CMD "?J5"
1260 REM 4942A NOW TALKS TO 9830A
1270 FORMAT 2F7.0
1280 ENTER (13,1270)A,B
1290 IF B=204 THEN 1350
1300 PRINT "GO TO LOCAL TEST FAILED"
1310 PRINT
1320 DISP "'CONT EXEC.' FOR SER. POLL TEST
1330 STOP
1340 GOTO 1470
1350 CMD "?U*"
1360 FORMAT 3B
1370 OUTPUT (13,1360)256,1,512;
1380 REM LAST 3 LINES EXECUTE GTL
1390 PRINT "THE 4942A SHOULD NOW"
1400 PRINT "BE UNDER LOCAL CONTROL."
1410 PRINT "IF FRONT PANEL CONTROL OF 4942A
1420 PRINT "IS REGAINED, THEN GTL IS WORKING.
1430 PRINT
1440 WAIT 2000
1450 DISP "'CONT EXEC.' FOR SER. POLL TEST
1460 STOP
```

Figure 3-11. Go to Local Test (1 of 3)

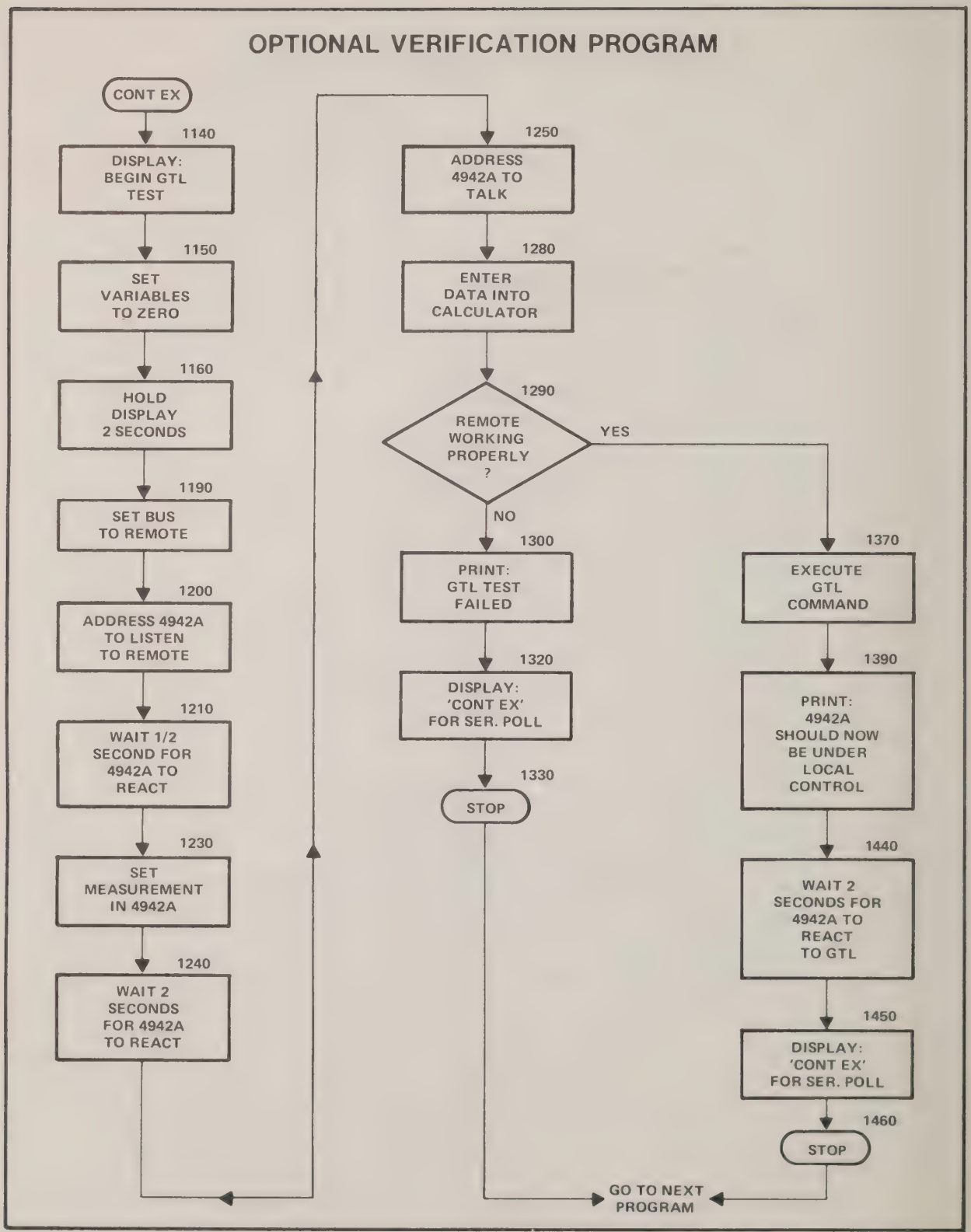


Figure 3-11. Go to Local Test (2 of 3)

OPTIONAL VERIFICATION PROGRAM

LINE NO.	EXPLANATION
1140	Display begin GTL test.
1150	Set variables to zero.
1160	Hold display for 2 seconds.
1170-1190	Set bus to remote.
1200	Address 4942A to listen to remote.
1210	Wait 1/2 second for 4942A to react.
1230	Set measurement in 4942A.
1240	Wait 2 seconds for 4942A to react.
1250	Address 4942A to talk.
1270-1280	Enter measurement data.
1290	Determine if 4942A working properly in remote.
1300	Print go to local test failed.
1320	Display instructions for going to next program.
1330	Stop program so operator can view instructions.
1340	Go to next program.
1350-1370	Issue GTL command.
1390-1420	Print expected test results.
1440	Wait 2 seconds for 4942A to react to GTL.
1450	Display instructions for going to next program.
1460	Stop program so operator can read instructions.

Figure 3-11. Go to Local Test (3 of 3)

OPTIONAL VERIFICATION PROGRAM

```
1470 A=B=Q=S=T=0
1480 PRINT "SETUP: LOOP T-R; ADJ. LEVEL TO 0.0 DBM"
1490 PRINT
1500 DISP "MAKE SETUP AND 'CONT EXECUTE'"
1510 STOP
1520 PRINT
1530 PRINT "BEGIN SERIAL POLL TEST"
1540 PRINT
1550 CMD "?U"
1560 FORMAT B
1570 OUTPUT (13,1560)768;
1580 CMD "?U*"
1590 WAIT 500
1600 CMD "?U*","R0M1D101E"
1610 WAIT 2000
1620 GOTO 1970
1630 FOR S=1 TO 10
1640 REM S GIVES 10 TRIES TO GET A=80 FOR TOTAL OF 20 SECONDS
1650 CMD "?U"
1660 FORMAT 5B
1670 OUTPUT (13,1660)256,95,53,24,512;
1680 REM LAST 3 LINES EXECUTE SPE
1690 CMD "J"
1700 Q=RBYTE13
1710 REM LAST 2 LINES READ THE STATUS BYTE FROM 4942A
1720 CMD "?U"
1730 FORMAT 3B
1740 OUTPUT (13,1730)256,25,512;
1750 REM LAST 3 STEPS EXECUTE SPD
1760 IF Q=80 THEN 1810
1770 REM IF Q=80 THEN 4942A REQUESTING SERVICE
1780 WAIT 2000
1790 IF S=10 THEN 1910
1800 NEXT S
```

Figure 3-12. Serial Poll Test (1 of 6)

OPTIONAL VERIFICATION PROGRAM

```
1810 CMD "?J5"
1820 FORMAT 2F7.0
1830 ENTER (13,1820)A,B
1840 PRINT "LEVEL & FREQUENCY TEST RESULTS"
1850 PRINT "    ";A;"DBM AT";B;"HZ"
1860 PRINT
1870 PRINT
1880 PRINT "SERIAL POLL FUNCTIONS PROPERLY"
1890 PRINT
1900 GOTO 1940
1910 PRINT
1920 PRINT "SERIAL POLL TEST FAILED"
1930 PRINT
1940 DISP "'CONT EXEC.' FOR MAS.-SLAVE OP."
1950 STOP
1960 GOTO 2060
1970 FOR T=1 TO 6
1980 REM T GIVES 6 TRIES TO GET SRQ FOR TOTAL OF 1 MINUTE
1990 DISP "TEST IN PROGRESS"
2000 WAIT 10000
2010 CMD "?U"
2020 IF STAT13 <= 1 THEN 1630
2030 REM LAST 2 LINES CHECK FOR SRQ ON BUS
2040 IF T=6 THEN 1910
2050 NEXT T
```

Figure 3-12. Serial Poll Test (2 of 6)

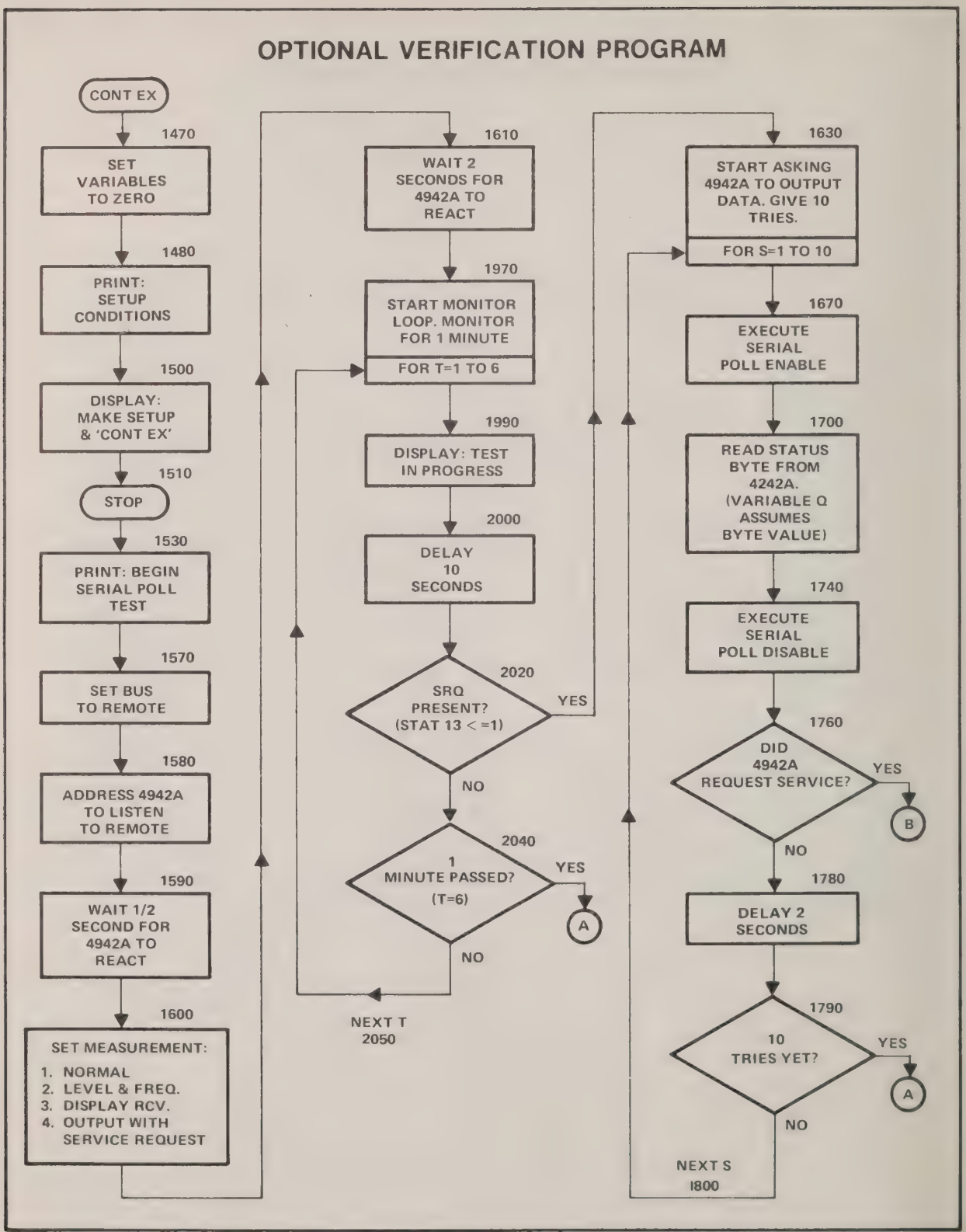


Figure 3-12. Serial Poll Test (3 of 6)

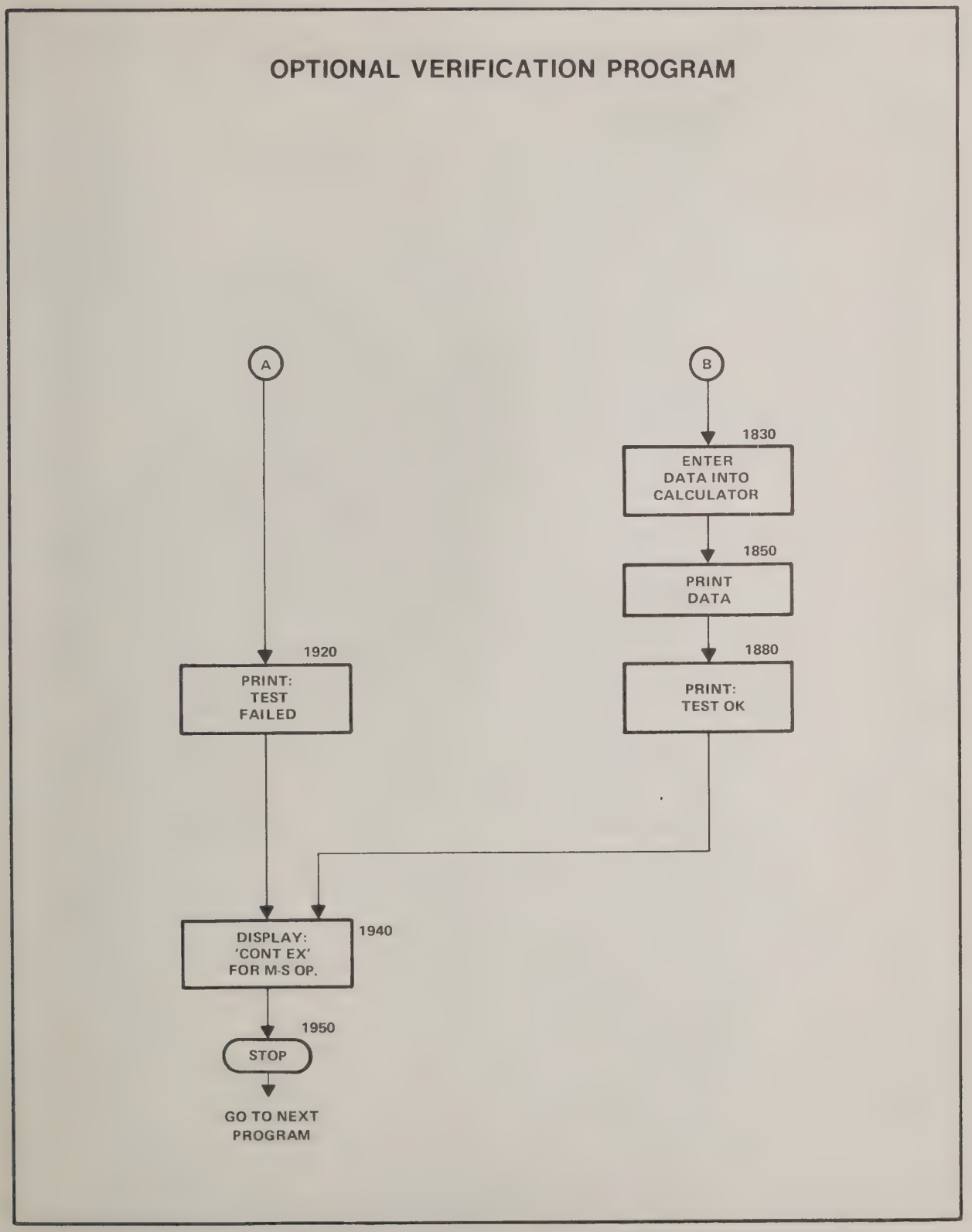


Figure 3-12. Serial Poll Test (4 of 6)

OPTIONAL VERIFICATION PROGRAM

LINE NO.	EXPLANATION
1470	Set variables to zero.
1480	Print setup conditions.
1500	Display operator instructions.
1510	Stop program to allow operator to make setup.
1530	Print title of test.
1550-1570	Set bus to remote.
1580	Address 4942A to listen to remote.
1590	Wait 1/2 second for 4942A to react.
1600	Set measurement in 4942A.
1610	Wait 2 seconds for 4942A to react.
1620	Go to SRQ monitor subroutine.
1630-1800	Serial poll subroutine.
1630	Start of FOR-NEXT loop. S gives 10 tries for total of 20 seconds to get A = 80.
1650-1670	Serial poll enable.
1690-1700	Address 4942A to talk and then read out its status byte.
1720-1740	Serial poll disable.
1760	Does 4942A status byte indicate it is requesting service.
1780	Delay program execution for 2 seconds.
1790	If 4942A is not ready to output data after 10 tries, then abort test.
1800	End of FOR-NEXT loop.
1810-1830	Enter measurement data into calculator.
1840-1850	Print the measurement data.
1880	Print test passed.
1900	Go to instructions for next test.

Figure 3-12. Serial Poll Test (5 of 6)

OPTIONAL VERIFICATION PROGRAM

LINE NO.	EXPLANATION
1920	Print test failed.
1940	Instructions to go to next programs.
1950	Stop program here so instructions can be seen.
1960	Go to next program.
1970-2050	Service request monitor subroutine.
1970	Start of FOR-NEXT loop. T gives 6 tries for total of 1 minute to get service request.
1990	Display test in progress.
2000	Hold display for 10 seconds.
2010-2020	Check for presence of service request on bus.
2040	If 4942A is not ready to request service after 1 minute, then abort test.
2050	End of monitor subroutine.

Figure 3-12. Serial Poll Test (6 of 6)

OPTIONAL VERIFICATION PROGRAM

```
2060 A=B=N=0
2070 PRINT "SETUP: 1. ADJ. LEVEL TO 0.0 DBM AT SLAVE AND MASTER"
2080 PRINT "        2. CONNECT SLAVE TO MASTER"
2090 PRINT "        3. SET REMOTE SWITCH TO 'SLAVE' AT SLAVE UNIT"
2100 PRINT
2110 DISP "MAKE SETUP AND 'CONT EXECUTE'"
2120 STOP
2130 PRINT "LEVEL & FREQUENCY TEST"
2140 PRINT
2150 PRINT "MASTER-TO-SLAVE DIRECTION"
2160 PRINT
2170 CMD "?U"
2180 FORMAT B
2190 OUTPUT (13,2180)768;
2200 CMD "?U*"
2210 WAIT 500
2220 CMD "?U*","R1M1D1F100400E"
2230 WAIT 10000
2240 CMD "?U*","Z0E"
2250 WAIT 2000
2260 GOSUB 2410
2270 PRINT
2280 PRINT "LEVEL & FREQUENCY TEST"
2290 PRINT
2300 PRINT "SLAVE-TO-MASTER DIRECTION"
2310 PRINT
2320 CMD "?U*","R2M1D1F100400E"
2330 WAIT 10000
2340 CMD "?U*","Z0E"
2350 WAIT 2000
2360 GOSUB 2410
2370 PRINT "END OF TEST"
2380 PRINT
2390 PRINT
2400 END
```

Figure 3-13. Master-Slave Operation (1 of 6)

OPTIONAL VERIFICATION PROGRAM

```
2410 REM BEGIN FREQUENCY STEP SUBROUTINE
2420 FOR N=204 TO 3804 STEP 400
2430 CMD "?U*"
2440 FORMAT "F",F1000.0,"E"
2450 OUTPUT (13,2440)N
2460 WAIT 2000
2470 CMD "?J5"
2480 FORMAT 2F7.0
2490 ENTER (13,2480)A,B
2500 IF A >= 9900 AND A <= 9914 THEN 2580
2510 IF A >= 90 AND A <= 91.4 THEN 2620
2520 IF A=99.9 OR A=9999 OR A=-99.9 OR A=-9999 THEN 2670
2530 IF B >= (N+2) OR B <= (N-2) THEN 2700
2540 FORMAT 4X,F1000.1,1X,"DB AT",1X,F1000.0,1X,"HZ"
2550 OUTPUT (15,2540)A,B
2560 NEXT N
2570 RETURN
2580 REM BEGIN ERROR CODE PRINT FOR NON-D.P.
2590 A=A-9900
2600 OUTPUT (15,2640)A
2610 GOTO 2370
2620 REM BEGIN ERROR CODE PRINT FOR D.P.
2630 A=(A*10)-900
2640 FORMAT 4X,"ERROR CODE H-",F1000.0," PRESENT"
2650 OUTPUT (15,2640)A
2660 GOTO 2370
2670 REM BEGIN OUT OF RANGE SUBROUTINE
2680 PRINT "OUT OF RANGE CONDITION"
2690 GOTO 2370
2700 REM BEGIN TRMT FREQ ERROR PRINT SUBROUTINE
2710 PRINT "WRONG TRANSMIT FREQUENCY PRESENT"
2720 GOTO 2370
```

Figure 3-13. Master-Slave Operation (2 of 6)

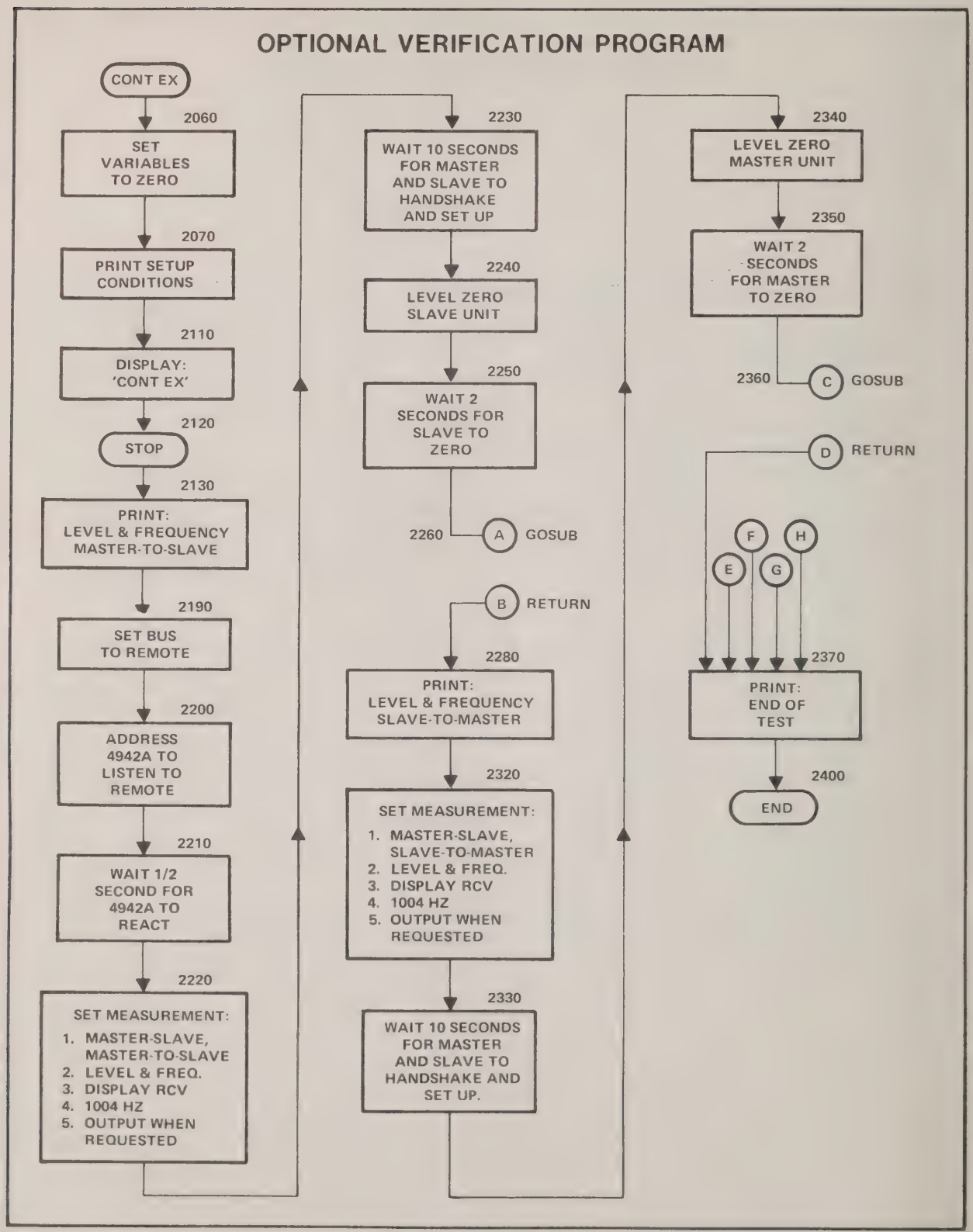


Figure 3-13. Master-Slave Operation (3 of 6)

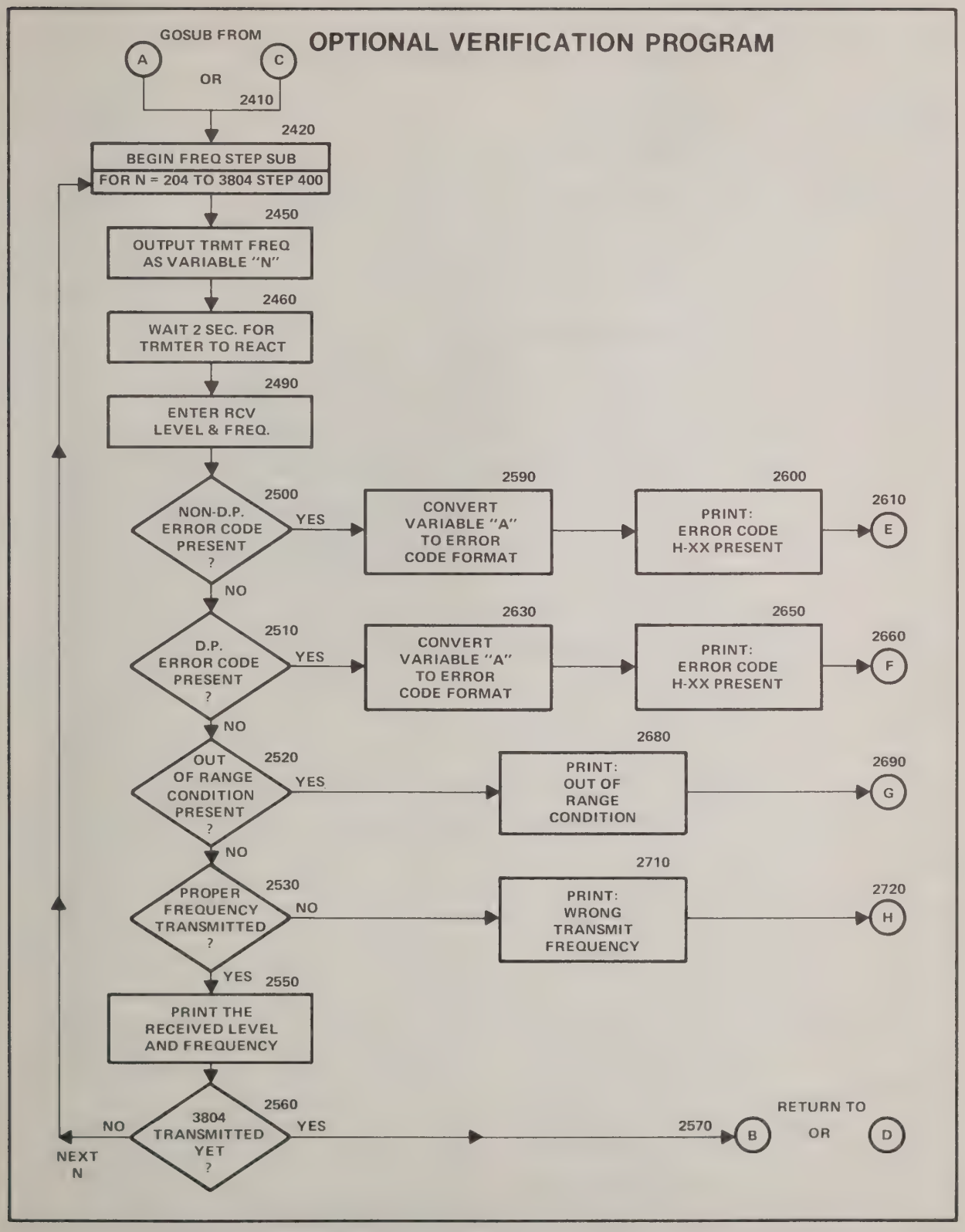


Figure 3-13. Master-Slave Operation (4 of 6)

OPTIONAL VERIFICATION PROGRAM

LINE NO.	EXPLANATION
2060	Set variables to zero.
2070-2100	Print setup conditions.
2110	Display instructions to continue program.
2120	Stop program so operator can make setup.
2130-2160	Print measurement header.
2170-2190	Set bus to remote.
2200	Address 4942A to listen to remote.
2210	Wait 1/2 second for 4942A to react.
2220	Set measurement in 4942A.
2230	Wait 10 seconds for master and slave to handshake and set up.
2240	Level zero the slave unit.
2250	Wait 2 seconds for slave to react.
2260	Go to frequency step subroutine.
2280-2310	Print measurement header.
2320	Set measurement in 4942A.
2330	Wait 10 seconds for master and slave to handshake and set up.
2340	Level zero the master unit.
2350	Wait 2 seconds for master to zero.
2360	Go to frequency step subroutine.
2370	Print end of test.
2400	End of main program.
2410-2560	Frequency step subroutine.
2420	Start of FOR-NEXT loop.
2430	Address 4942A to listen.

Figure 3-13. Master-Slave Operation (5 of 6)

OPTIONAL VERIFICATION PROGRAM

LINE NO.	EXPLANATION
2450	Output variable "N" as the transmitted frequency specification.
2460	Wait 2 seconds for 4942A to react.
2470	Address 4942A to talk.
2490	Enter measurement data into calculator.
2500	Check for presence of non-decimal point error codes.
2510	Check for presence of decimal point type error codes.
2520	Check for presence of out of range condition.
2530	Check for presence of wrong transmit frequency.
2550	Print the measurement data.
2560	End of FOR-NEXT loop.
2570	Return to main program.
2590	Convert variable "A" data into format suitable for printout.
2600	Print the error code.
2610	Go back to main program.
2630	Convert variable "A" data into format suitable for printout.
2650	Print the error code.
2660	Go back to main program.
2680	Print out of range condition.
2690	Go back to main program.
2710	Print wrong transmit frequency.
2720	Go back to main program.

Figure 3-13. Master-Slave Operation (6 of 6)

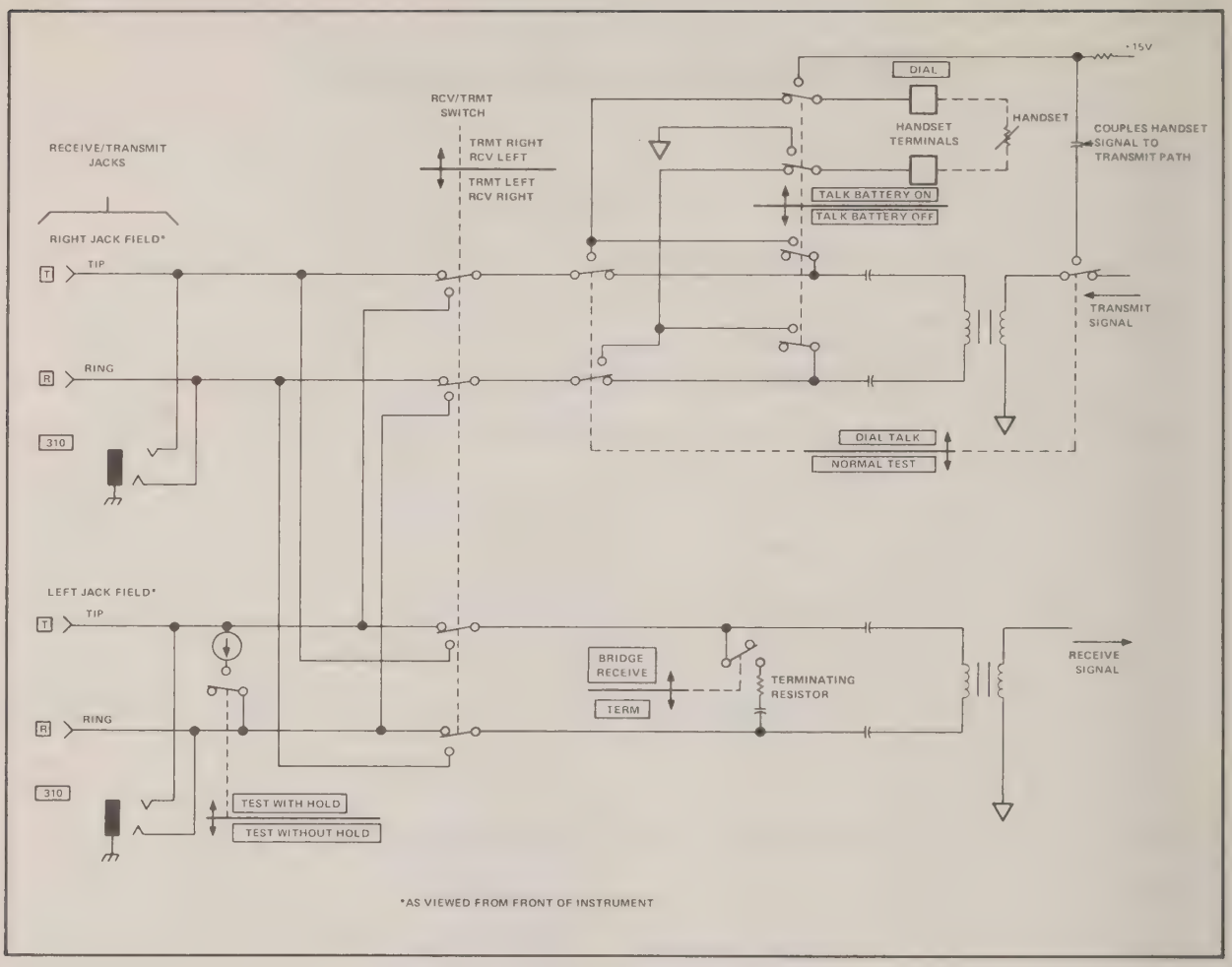


Figure 3-14. Input Switching

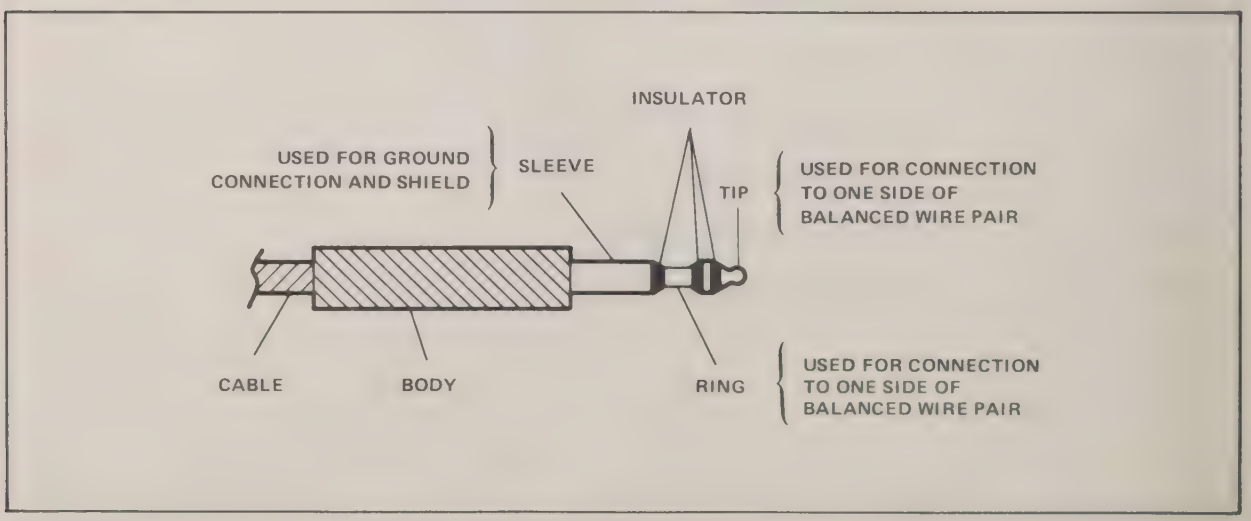


Figure 3-15. Western Electric 310 Plug

3-37. MEASUREMENT PRINCIPLES

3-38. The following text describes the principles of all measurements made by the Model 4942A. Block diagrams and functional descriptions are provided to explain input-output switching and the different measurements.

3-39. INPUT-OUTPUT SWITCHING

3-40. The receive/transmit jacks provide for interconnection of the 4942A to the telephone circuit under test. See Figure 3-14. The RCV/TRMT switch provides for selection of either the transmit or receive function for the left jack field, and simultaneously selects the opposite for the right jack field. Both the left and right jack fields provide parallel (multipled) connection jacks: standard five-way binding posts on top and Western Electric 310 type jacks on the bottom. Either the binding posts or the 310 jacks may be used; both of them should not be used at the same time. Figure 3-15 shows the construction of the 310 plug.

3-41. The TEST WITH HOLD/TEST WITHOUT HOLD setup switch allows the application of a 23 mA current source to the left jack field T and R (Tip and Ring) connectors. This provides for the latching of telephone switching equipment required in certain applications (functions as a holding coil).

3-42. The input and output impedance of the 4942A is selectable at either 600 or 900 ohms (not shown in Figure 3-14), which are standard telephone circuit values. The impedance of the 4942A must be selected to match the circuit under test, or erroneous measurement values will be obtained.

3-43. The receive input may be terminated or bridged across the circuit under test. The terminated mode provides a resistive termination on the receive circuit to provide proper loading. When a termination is provided by some other device, then it is not necessary (nor desirable) to provide a termination. In this case the receive input is used in the bridged mode, which provides a high impedance receive input (greater than 50k-ohms).

3-44. The 4942A input and output circuits are balanced to match standard telephone circuits. A balanced circuit is one that is electrically symmetrical; the two sides of the circuit have equal series resistance, series inductance, shunt capacitance, and leakage to ground. Only instruments with balanced inputs will operate properly when connected to a balanced circuit.

3-45. To allow dialing, talking, and listening over the circuit under test, handset terminals (DIAL) are provided for the connection of a lineman's handset. In addition, a +15V source (talk battery) is selectable for series application to the handset terminals. This allows the handset to become an ac signal source for application to the circuit under test.

3-46. LEVEL AND FREQUENCY MEASUREMENTS

3-47. The level and frequency mode allows measurement of 1000 Hz loss (or gain) and attenuation distortion. These measurements define the amplitude-versus-frequency response of a telephone circuit. Figure 3-16 illustrates the basic setup for these measurements.

3-48. 1000 Hz LOSS. The 1000 Hz loss measurement determines the point-to-point loss (or gain) of a 1000 Hz test frequency transmitted over a telephone circuit. To make this measurement, a 1004 Hz test frequency is transmitted at one end of the circuit, and its power (in dBm) is measured at the other end. The transmitted power is compared with the received power to determine 1000 Hz loss.

3-49. The transmitted frequency is actually 1004 Hz (not 1000 Hz) to prevent measurement errors which would occur over certain telephone circuits. The 4942A offsets all stepped transmitter frequencies by 4 Hz.

3-50. ATTENUATION DISTORTION. The attenuation distortion measurement determines the amplitude-versus-frequency characteristics of a telephone circuit; using a single frequency measurement technique. To make this measurement, a 1004 Hz test frequency is transmitted. At the receiving end, the received power is recorded to obtain a 1004 Hz reference level. The transmitted frequency is then varied over the full transmitter range (while maintaining a constant transmitted level), and the received power is noted in each case. The received powers may then be compared to the 1004 Hz received reference power to obtain the frequency attenuation characteristics of the circuit in dBm.

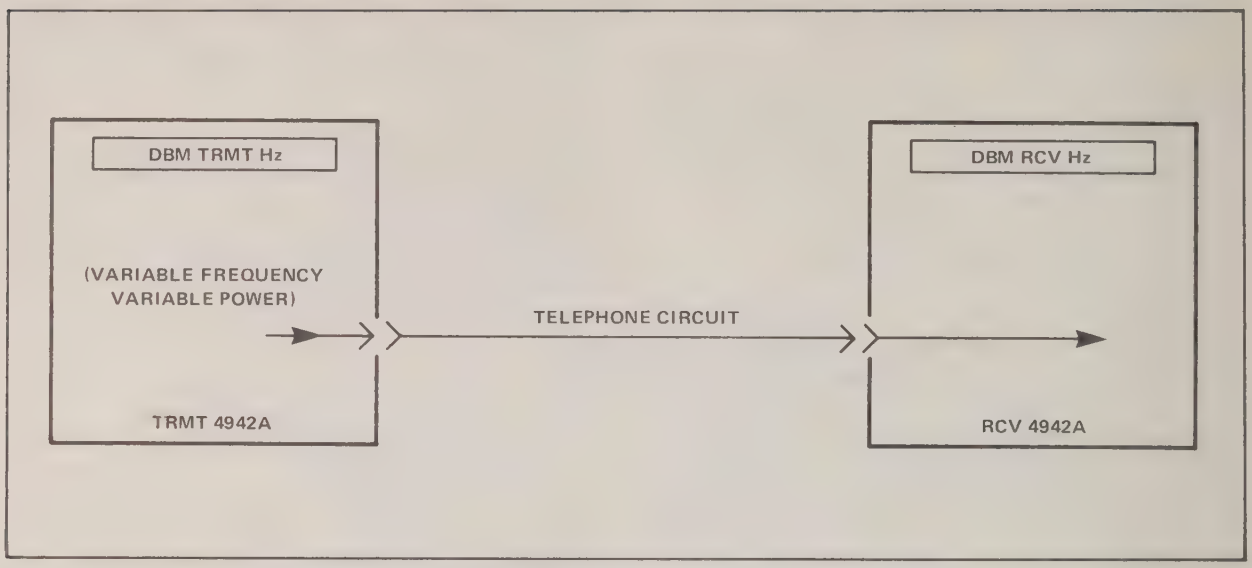


Figure 3-16. Level and Frequency Measurement

3-51. To directly obtain the loss deviations relative to 1004 Hz, the LEVEL ZERO switch is depressed during reception of the 1004 Hz reference signal. This action stores the received power in dBm and simultaneously displays this level as 0 dB. Level readings taken at other frequencies will then be displayed in units of dB as compared to the 1004 Hz reference. This eliminates the need to subtract the 1004 Hz reference level from other levels at other frequencies to obtain dB readings.

3-52. According to telephone industry convention, attenuation distortion is defined as a change in loss of a telephone circuit, compared to the loss of a nominal 1000 Hz signal on that circuit. For example, a circuit with 6 dB more loss at 2800 Hz would have an attenuation distortion of +6 dB.

3-53. The SF (single-frequency) SKIP setup switch is provided to automatically prevent the test set from transmitting frequencies within the range of 2450 Hz to 2750 Hz. This feature is used in attenuation distortion and envelope delay to prevent the dropping out of the telephone circuit connection.

3-54. C-MESSAGE NOISE MEASUREMENT

3-55. The C-message noise mode allows measurement of the electrical noise on a telephone circuit. Figure 3-17 illustrates the basic setup for this measurement.

3-56. The C-message mode measures the noise on a telephone circuit, which has a quiet termination on one end (supplied by transmitting 4942A) and a weighted measuring device on the other end (receiving 4942A). The quiet termination is a simple resistive termination on the wire pair.

3-57. At the measurement end of the telephone circuit, the 4942A includes a frequency weighting (shaped) filter of C-message response (see Figure 3-18). The C-message filter allows measurement of only those noise signals that bother the "typical" subscriber of standard telephone service; the rest are excluded.

3-58. Received noise levels are displayed in units of dBrnC, or dB with respect to reference noise (1000 Hz tone at –90 dBm). For example, a noise reading of 20 dBrnC has an RMS power of –70 dBm (20–90 = –70). With the C-message filter, displayed readings are in units of dBrnC, or noise level in dBrn with a C-message weighted measuring device.

3-59. In addition to measuring noise on a telephone line, the 4942A may be used to listen to that noise. The line monitor speaker provides an amplified reproduction of the signal present at the filter output.

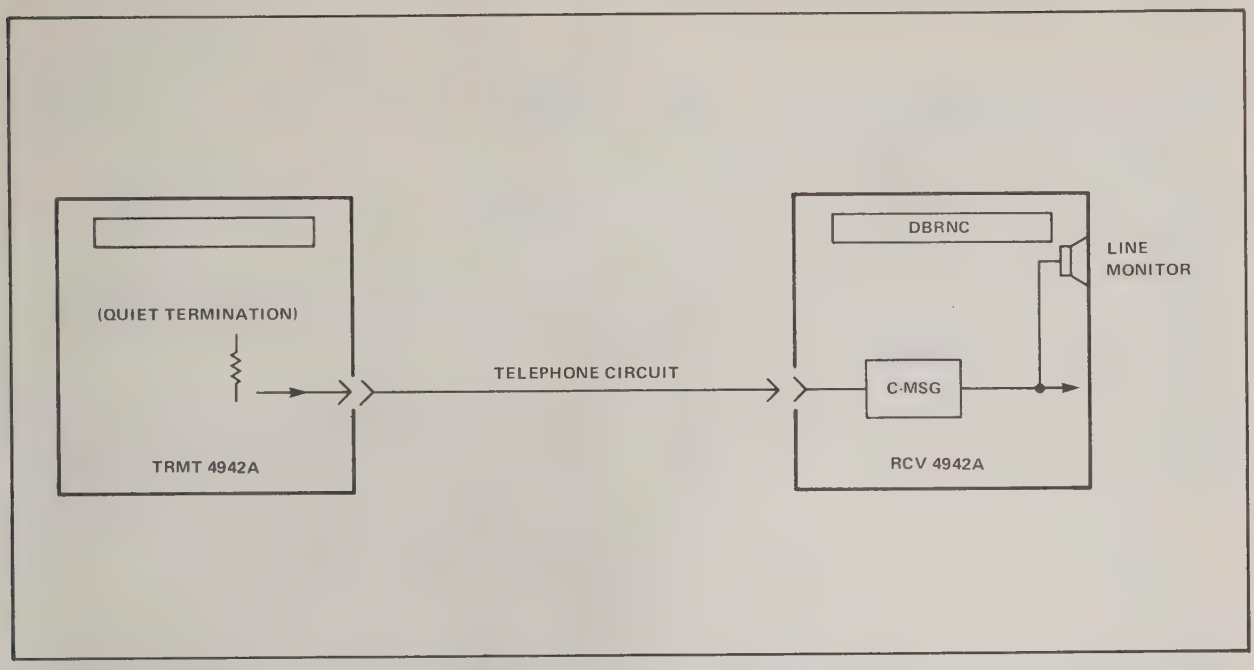


Figure 3-17. C-Message Noise Measurement

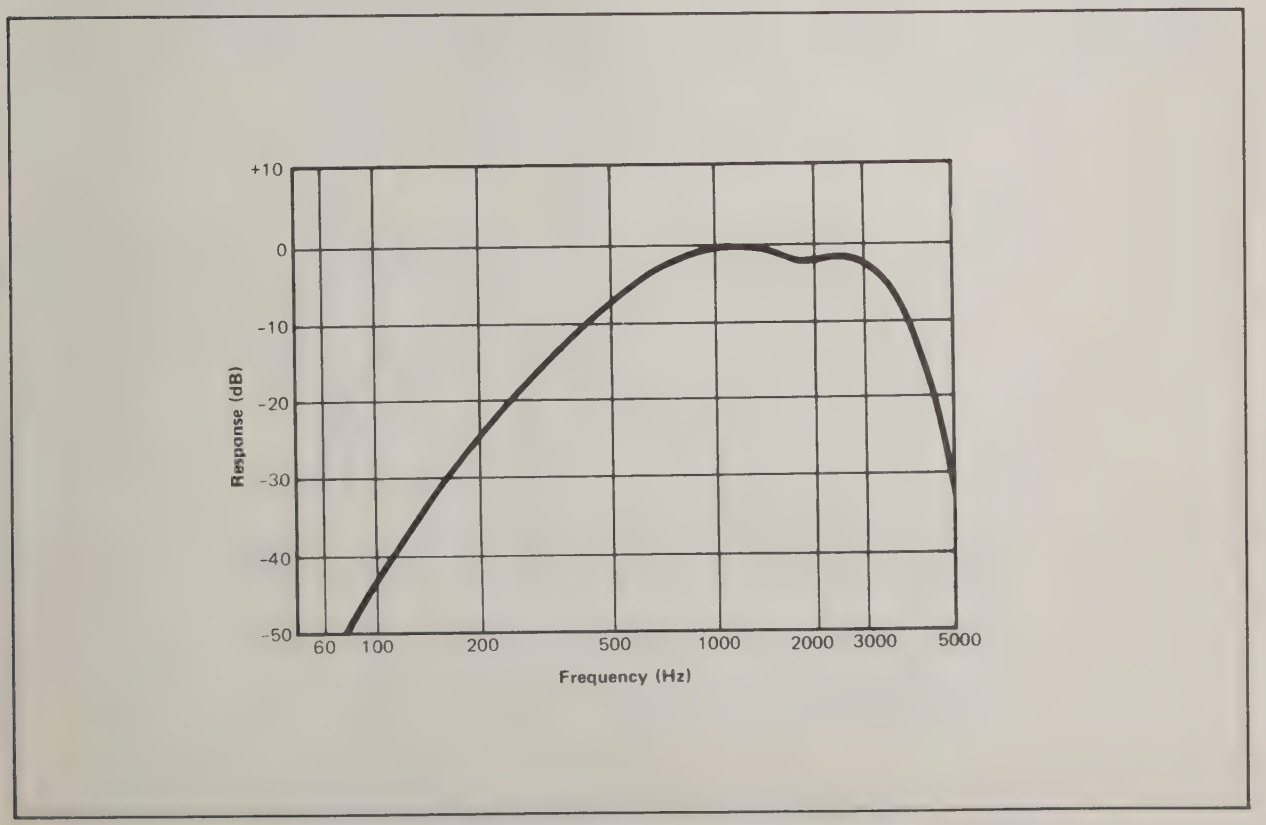


Figure 3-18. C-Message Weighting

3-60. NOISE-WITH-TONE MEASUREMENT

3-61. The noise-with-tone mode allows measurement of telephone circuit noise in the presence of a transmitted test frequency.

3-62. To make this measurement, a 1004 Hz test frequency is transmitted. At the receiving 4942A, the 1004 Hz signal is selectively attenuated by 50 dB using a notch filter (all frequencies between 995 Hz and 1025 Hz are attenuated by at least 50 dB). The remaining received signal (noise) is passed through a C-message filter for measurement. The received noise level is displayed in units of dBrnC. Figure 3-19 illustrates the combination of the C-message weighting and notch filter characteristics.

3-63. SIGNAL-TO-NOISE MEASUREMENT

3-64. The signal-to-noise mode allows measurement of the ratio of received signal-plus-noise power to noise power (S + N/N).

3-65. To make this measurement, a 1004 Hz test frequency is transmitted over the telephone circuit. At the receiving 4942A, the 1004 Hz signal is selectively attenuated by 50 dB using the notch filter. The remaining received signal (noise) is then compared with the original signal-plus-noise signal. The computed signal-to-noise ratio is then displayed in units of dB. Figure 3-20 illustrates this measurement.

3-66. IMPULSE NOISE MEASUREMENT

3-67. This measurement mode allows a count of the impulse noise spikes over a selected time interval.

3-68. Impulse noise is that component of the received noise signal which is much greater in amplitude than the normal peaks of the message circuit noise. It occurs as short duration spikes and/or bursts of energy. Waveform (b) in Figure 3-21 illustrates a received test signal that includes interfering impulse noise spikes.

3-69. The impulse noise measurement allows determination of impulse noise count on a telephone circuit, given a selected amplitude threshold level and a selected measurement period. The 4942A is internally programmed to register a maximum of 7 counts per second. This arrangement agrees with the Bell Telephone System measurement standard.

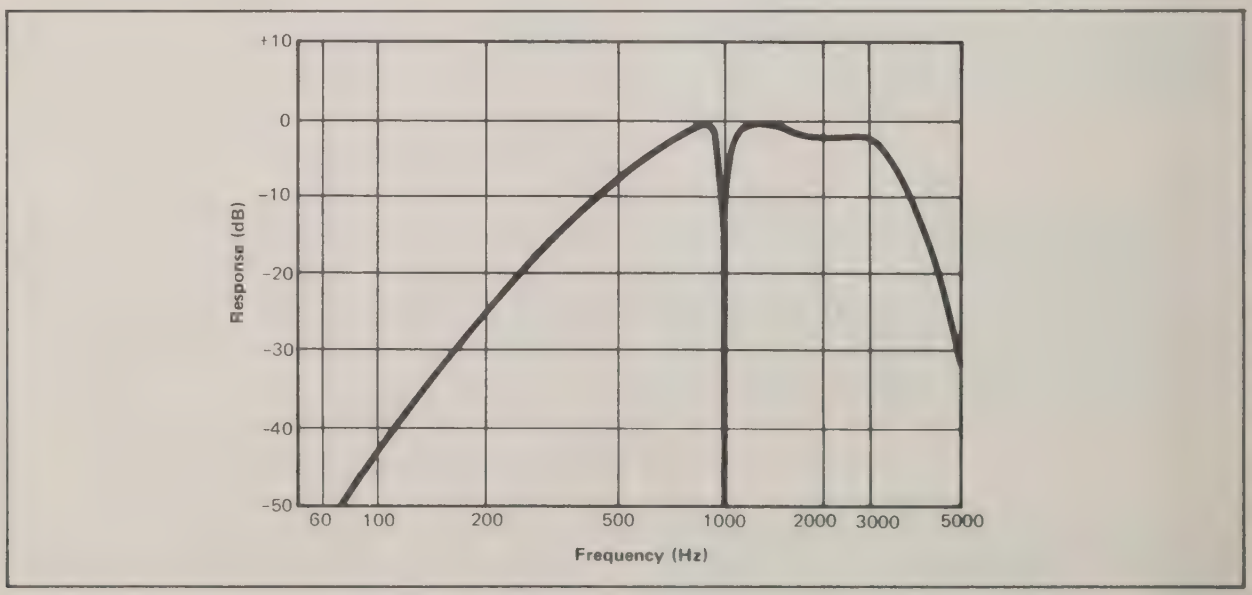


Figure 3-19. C-Message Weighting with Notch

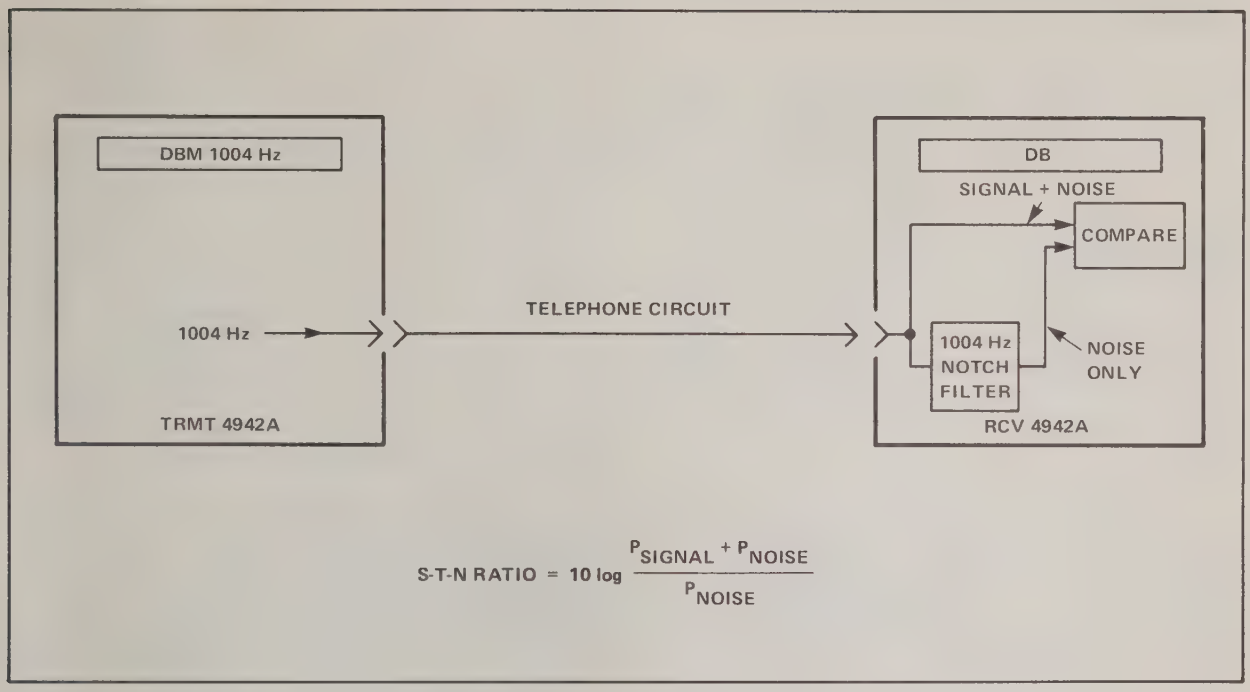


Figure 3-20. Signal-to-Noise Measurement

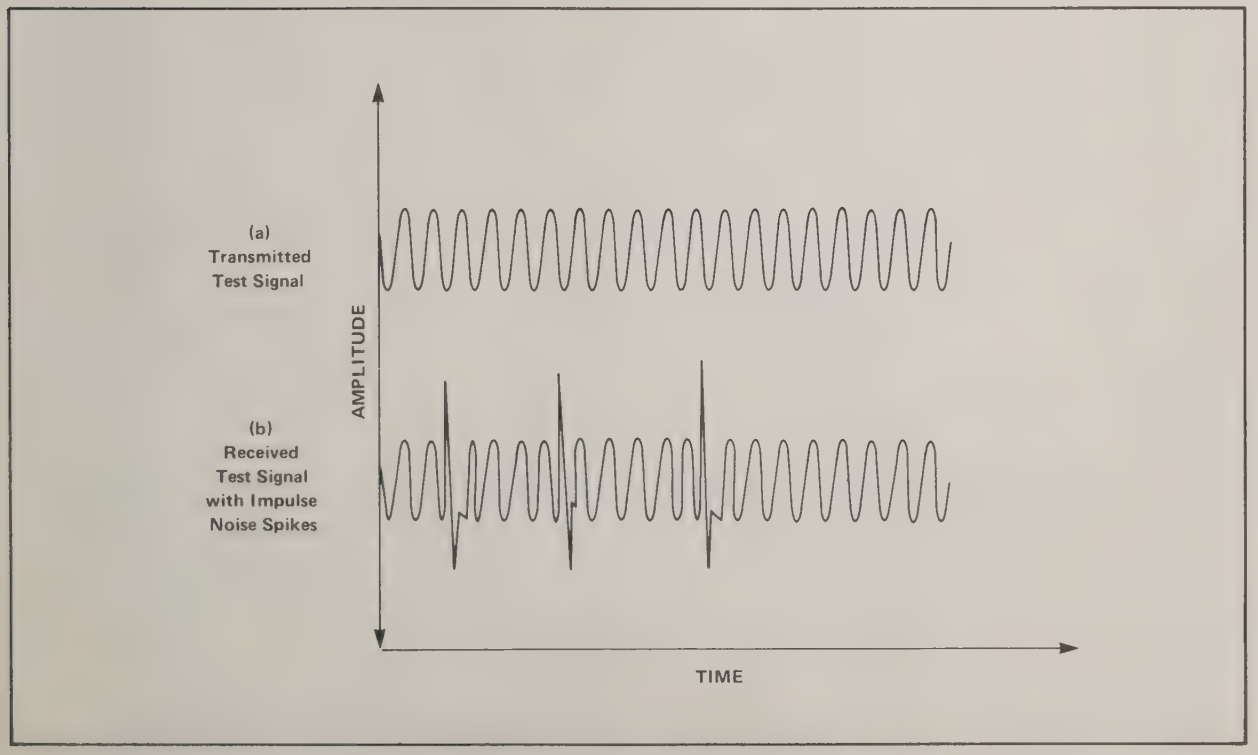


Figure 3-21. Impulse Noise Waveforms

3-70. ENVELOPE DELAY MEASUREMENT

3-71. The envelope delay mode allows measurement of the phase-versus-frequency characteristics of a telephone circuit.

3-72. An ideal circuit which has a linear phase shift characteristic will produce a straight line slope. This slope represents a linear relationship between a change in frequency and a corresponding change in phase as shown in Figure 3-22a. The practical circuit, however, is never ideal and will produce a nonlinear phase shift characteristic (phase distortion) as shown in Figure 3-22b.

3-73. Conventional measurement techniques make it difficult to measure the absolute phase characteristic of a transmission system, since a phase reference is difficult to establish at the receiving end of the circuit. It is possible, however, to measure relative phase shift at the receiving end using the envelope delay measurement technique. This technique makes it possible to measure the envelope delay distortion of a telephone circuit, which provides a relative measure of the phase linearity (or non-linearity) of the circuit.

3-74. RELATING PHASE SHIFT TO ENVELOPE DELAY. Amplitude modulating a low frequency sine wave (f_m) onto a carrier frequency (f_c) produces an amplitude modulated (AM) signal as shown by waveforms (a), (b), and (c) in Figure 3-23. The envelope of the AM signal is the outline (or shape) of the peak excursions of the modulated signal as shown in waveform (d) of Figure 3-23. The AM process produces a signal whose spectrum consists of the carrier frequency plus an upper sideband ($f_c + f_m$) and a lower sideband ($f_c - f_m$). Figure 3-24 illustrates this relationship. Since the upper sideband is of a higher frequency than the carrier, it undergoes a greater phase shift than the carrier; since the lower sideband is of a lower frequency, it undergoes less phase shift.

3-75. If the AM signal is passed through a circuit having a phase shift characteristic which increases linearly with frequency (Figure 3-22a), the envelope of the AM signal experiences a shift in time (or delay) as shown in waveforms (d) and (e) of Figure 3-23. This occurs because the lower sideband experiences less phase shift than the carrier, while the upper sideband encounters more. The net result of these phase shifts is that the modulation envelope is shifted in phase (or delayed) when traveling over a transmission medium.

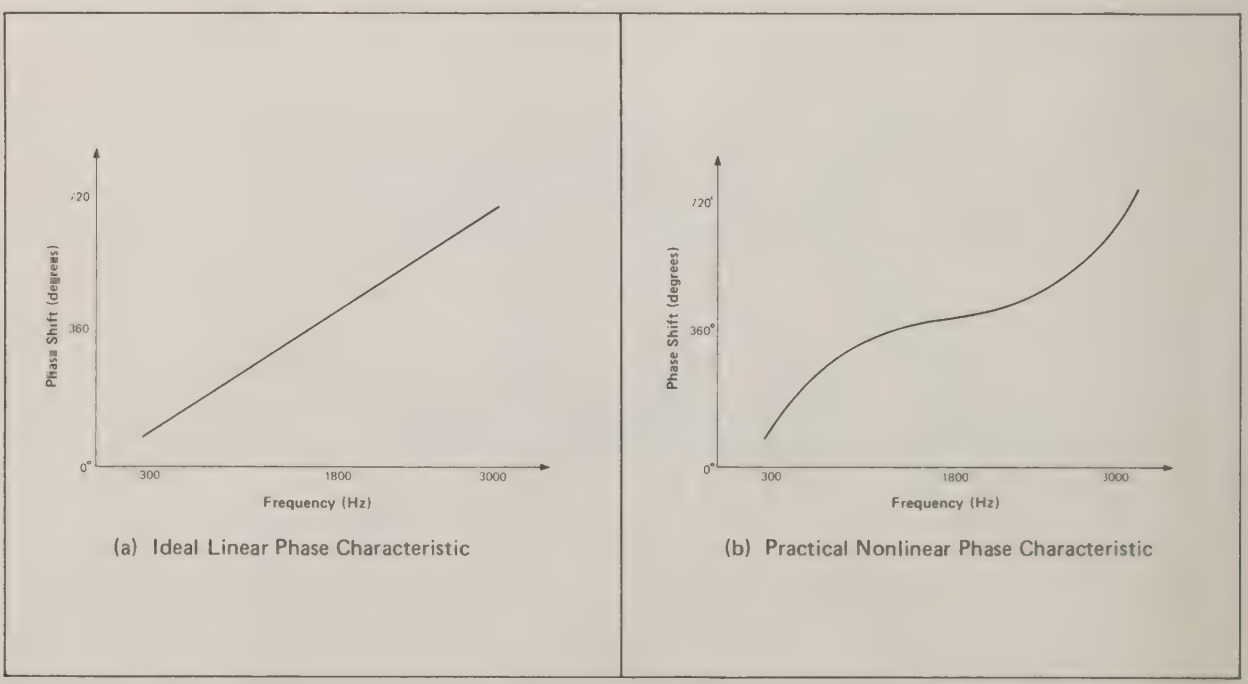


Figure 3-22. Phase-versus-Frequency Relationships

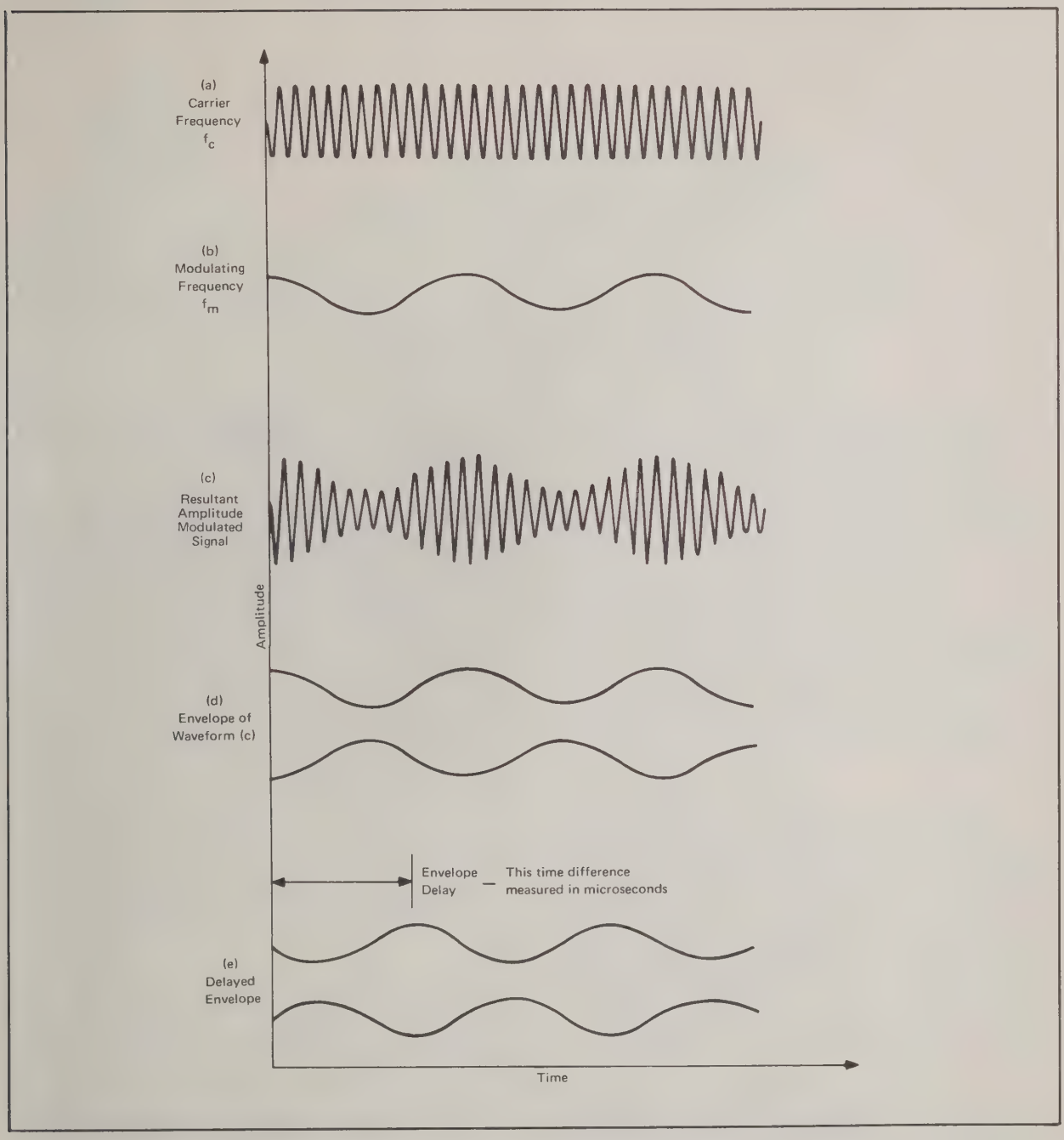


Figure 3-23. Envelope Delay Waveforms

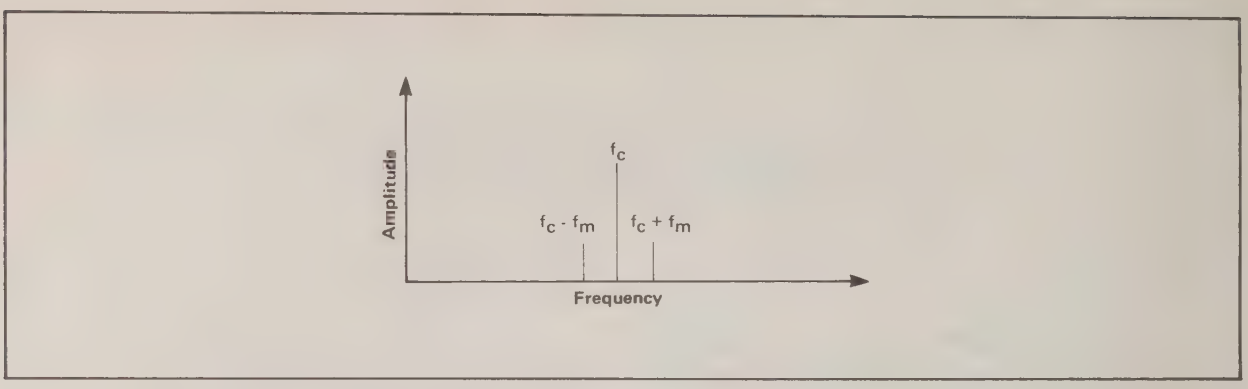


Figure 3-24. AM Signal Frequency Spectrum

3-76. The amount of envelope delay is related to the difference in phase between the two sidebands. If the phase-versus-frequency characteristic of the transmission medium is linear, then any carrier frequency used (with a fixed modulation frequency) will produce a constant envelope delay value. Plots (a) and (b) in Figure 3-25 illustrate this. However, if the phase-versus-frequency characteristic is nonlinear, then different carrier frequencies will produce different envelope delay values. Plots (c) and (d) in Figure 3-25 illustrate this. *When different values of envelope delay occur, the difference between delay values at two different carrier frequencies is termed "envelope delay distortion".*

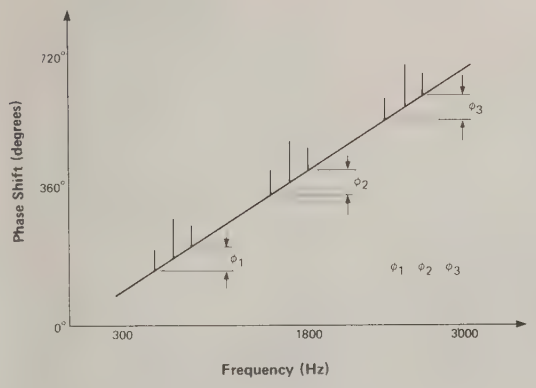
3-77. ENVELOPE DELAY MEASUREMENT TECHNIQUE. To make this measurement, two test sets are used in the configuration shown in Figure 3-26. The normal set transmits a test signal over the circuit under test to the repeat set. The repeat set responds by transmitting envelope delay information back to the normal set over the return reference circuit. The normal set compares its received signal with its transmitted signal to determine envelope delay distortion values.

3-78. The normal set transmits an amplitude modulated test signal consisting of a variable frequency carrier (204 to 3904 Hz) and a fixed modulation frequency (83-1/3 Hz). The carrier frequency is varied over the band of interest, usually in 100 Hz steps. The test signal travels the circuit under test and is received by the repeat set. The receiver of the repeat set amplitude demodulates the incoming test signal to produce the AM envelope. Changing the carrier frequency as mentioned above will result in a change in the delay of the 83-1/3 Hz envelope at the repeat set, if envelope delay distortion exists. The envelope delay values received at the repeat set must now be transmitted back to the normal set for measurement.

3-79. In the repeat set, the demodulated AM signal is used to amplitude modulate the fixed frequency carrier that is transmitted back to the normal set. The repeat set carrier oscillator remains fixed at one frequency during the envelope delay measurement. The carrier frequency is usually selected at midband (nominally 1804 Hz) because envelope delay characteristics are fairly constant and attenuation distortion characteristics are fairly flat. Since a constant return frequency is used by the repeat set, there will be no envelope delay distortion encountered by the return reference signal (although there will be a fixed envelope delay). Therefore, the envelope delay value received at the normal set will represent the envelope delay value received at the repeat set, plus the constant envelope delay of the return reference circuit.

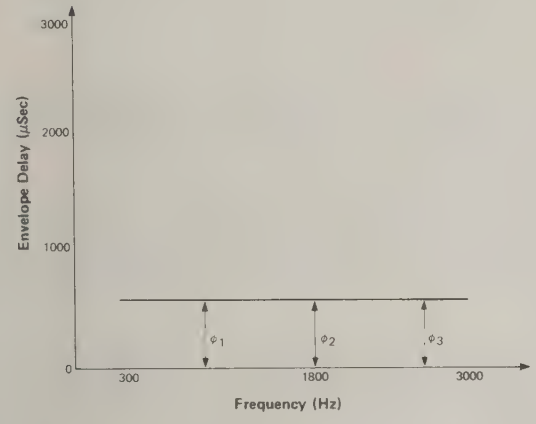
3-80. The receiver of the normal set then amplitude demodulates the incoming return reference signal. The phase of the incoming return reference envelope is then compared with the original 83-1/3 Hz oscillator signal to determine the difference in phase (envelope delay) between the two signals.

3-81. To measure the change in envelope delay from the normal set to the repeat set (with a change in carrier frequency), a DELAY ZERO control is used to "zero out" the fixed envelope delay of the entire measurement loop. The delay zero control sets the phase difference (or envelope delay) between the 83-1/3 Hz oscillator and the return reference envelope to zero. This zeroing is usually done at a normal set transmit frequency of



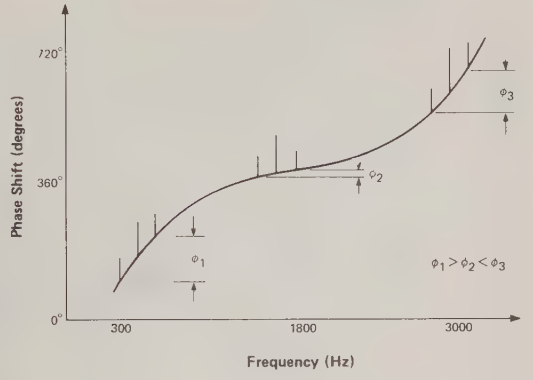
(a) Linear Phase Characteristic with Superimposed AM Signal Components

04940-A-21



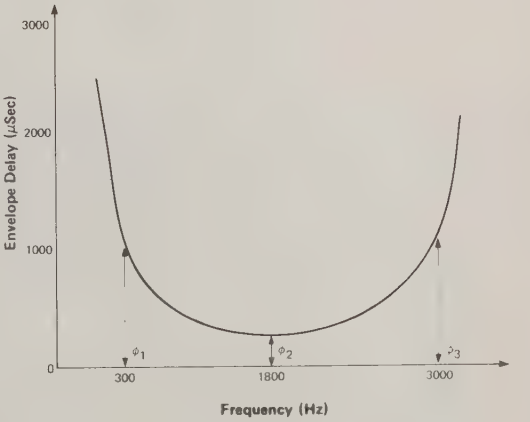
(b) Envelope Delay Characteristic of (a) above.

04940-A-22



(c) Nonlinear Phase Characteristic with Superimposed AM Signal Components

04940-A-23



(d) Envelope Delay Characteristic of (c) above.

04940-A-24

NOTE: The symbol phi (ϕ) represents the difference in phase between the upper and lower sidebands of the AM signal superimposed on the phase characteristic plots.

Figure 3-25. Relating Phase Shift to Envelope Delay

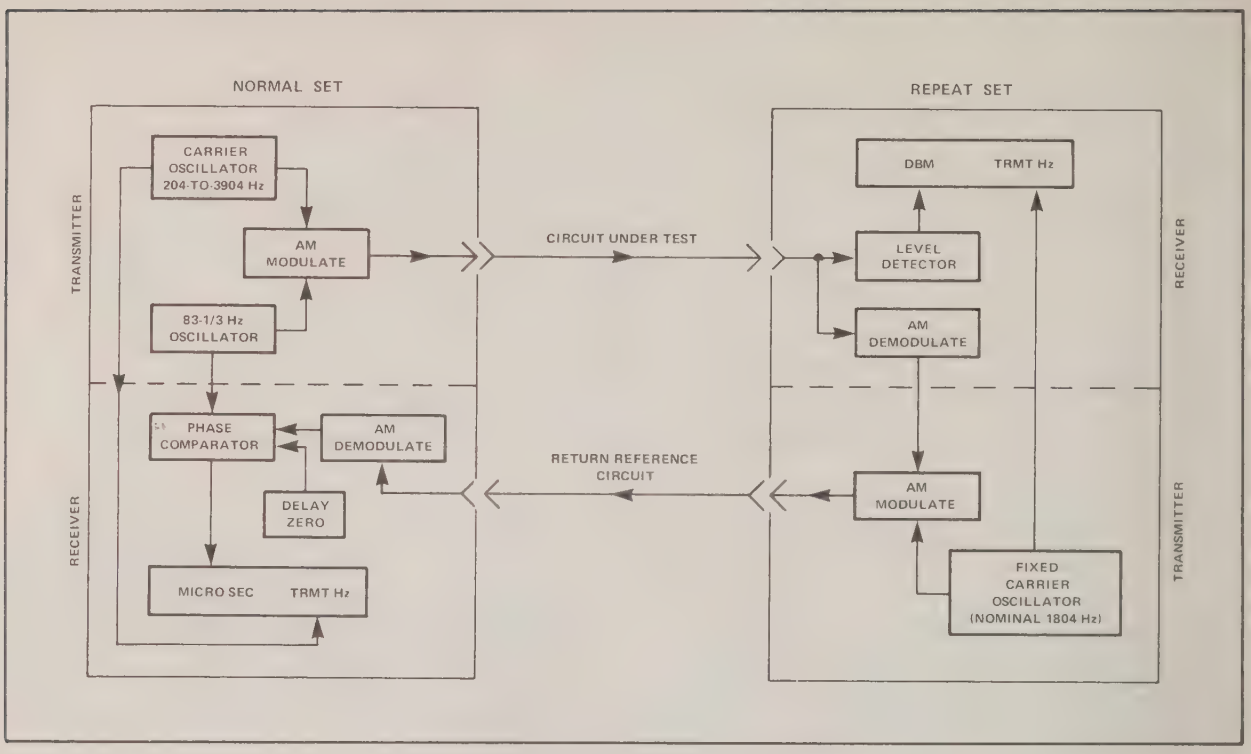


Figure 3-26. Envelope Delay Measurement

1804 Hz. All future envelope delay measurements will then be referenced to the 1804 Hz carrier frequency of the normal set. By changing the normal set carrier frequency from the delay zero reference value, the only changing envelope delay (envelope delay distortion), occurring in the measurement loop, is that incurred by the test signal on the circuit under test.

3-82. RETURN REFERENCE OR FORWARD REFERENCE OPERATION

3-83. The envelope delay measurement may be performed using the 4942A in either the forward or return measurement mode. *The terms "forward" and "return" refer to the direction of the "reference carrier signal", with respect to the normal test set.* Figure 3-26 in the previous text illustrated the return reference arrangement in detail. It is possible, however, to make the measurement with the normal set generating the reference carrier signal. In both cases, the normal set makes the actual measurement while the repeat set transfers the incoming 83-1/3 Hz modulation onto its transmitted carrier.

3-84. The advantage of using both techniques is in getting all measurement data at one end of the telephone circuit. Figure 3-27 shows how this is done.

3-85. In Figure 3-27a, the variable frequency carrier is sent by the normal set to the repeat set. In (b), the variable frequency carrier is sent by the repeat set. In both cases, the repeat set functions as a repeater for the 83-1/3 Hz modulation. In both cases the normal set measures the change in envelope delay (in microseconds). Therefore envelope delay distortion can be measured in either case.

3-86. The normal set is in essence detecting the changing envelope delay where the carrier is changing. In Figure 3-27a, the normal set measures the distortion in the forward direction. In (b), the normal set measures in the return direction.

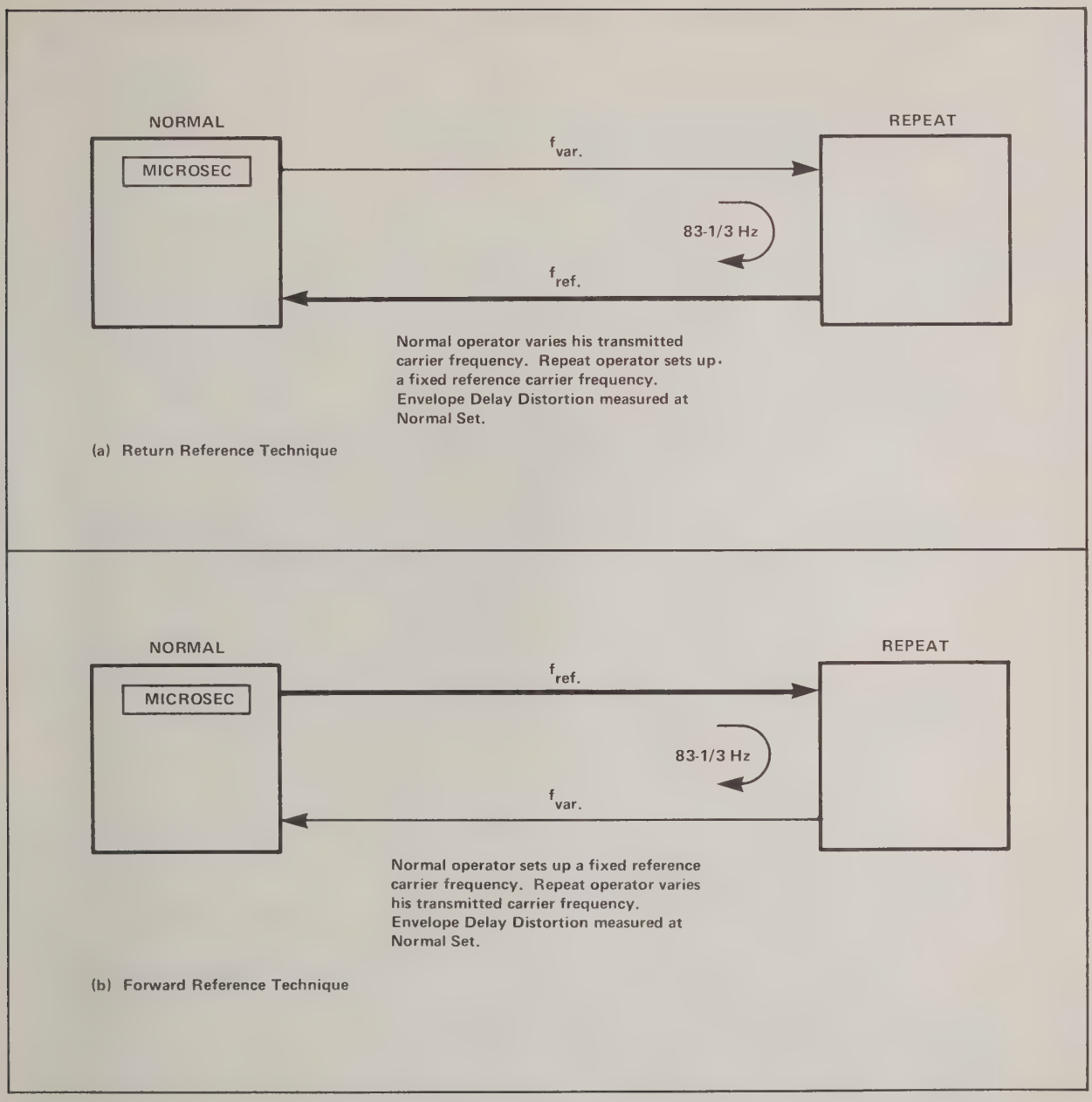

NORMAL
MICROSEC
REPEAT
$f_{var.}$
83-1/3 Hz
$f_{ref.}$
Normal operator varies his transmitted carrier frequency. Repeat operator sets up a fixed reference carrier frequency. Envelope Delay Distortion measured at Normal Set.
(a) Return Reference Technique
NORMAL
MICROSEC
REPEAT
$f_{ref.}$
83-1/3 Hz
$f_{var.}$
Normal operator sets up a fixed reference carrier frequency. Repeat operator varies his transmitted carrier frequency. Envelope Delay Distortion measured at Normal Set.
(b) Forward Reference Technique

Figure 3-27. Return and Forward Reference

3-87. LINE LOOP BACK

3-88. In this application, the Model 4942A serves as an audio frequency repeater. What comes in goes back out. The test set is selective in that the frequency range passed is between 200 and 3904 Hz. The transmitted output level is selected by the test set operator within the normal range of the instrument.

3-89. This operating mode of the 4942A is used for making loop-around measurements of telephone circuitry. This allows, for instance, a test set at the far end of the circuit to check the continuity of the looped-around circuit.

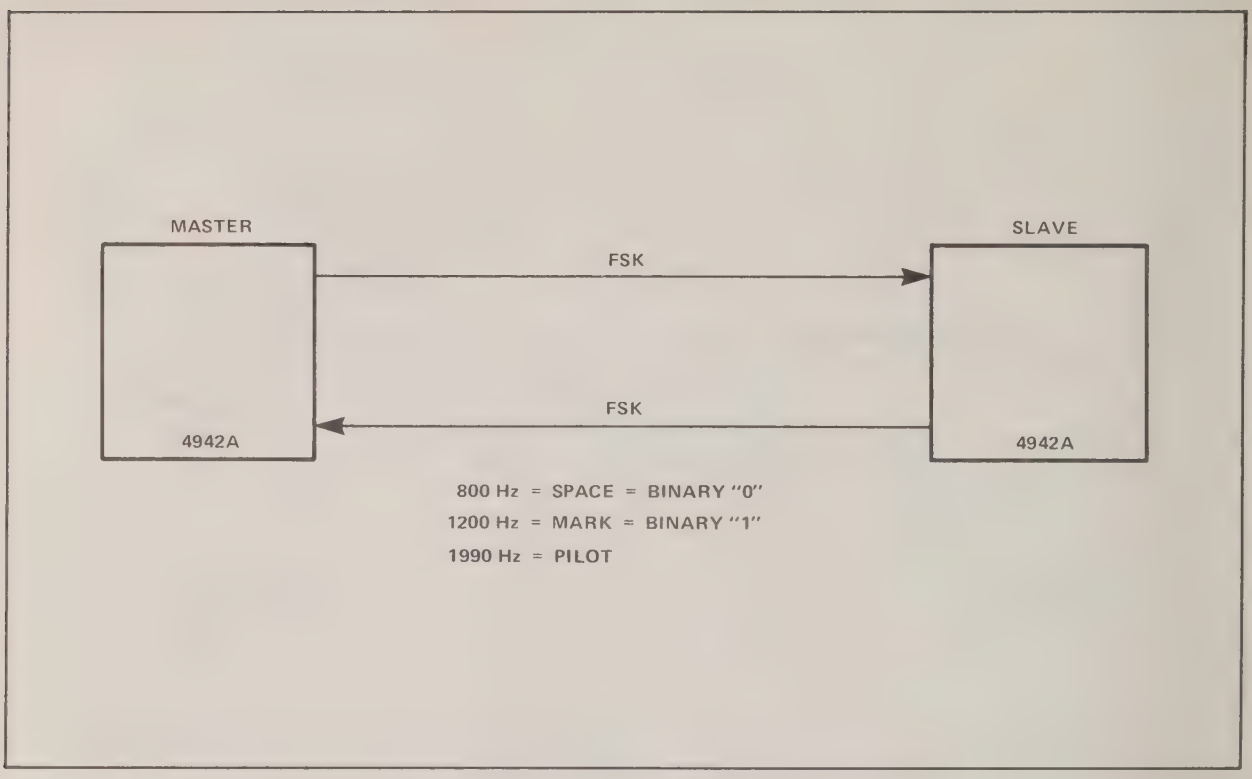


Figure 3-28. FSK Communication

3-90. MASTER-SLAVE OPERATION

3-91. The master-slave feature of the Model 4942A allows remote control of the slave unit by the master unit. The front panel NORMAL-MASTER-SLAVE switch selects the mode of operation for a particular unit. When set to NORMAL, the test set is manually controlled. When set to MASTER, the test set controls the operation of itself and the slave. When set to SLAVE, the front panel controls are disabled except for the TRANSMITTER OUTPUT LEVEL control, the IMPULSE NOISE THRESHOLD switch, and the SETUP CONTROLS.

3-92. HANDSHAKE ROUTINE. The master unit links up with the slave unit by performing a "handshake" routine. The two units "shake hands" or "talk" to each other over the telephone circuit, using frequency shift keying (FSK). The FSK scheme employed is an 800-1200 Hz shift (see Figure 3-28). The 1200 Hz signal represents a mark (binary 1) while the 800 Hz signal represents a space (binary 0). A 1990 Hz signal accompanies the FSK signal and serves as its pilot. This pilot serves to "alert" the receiving unit that FSK is arriving. The FSK pilot is used to confirm the presence of FSK data, and therefore helps prevent the erroneous reception of noise as data bits.

3-93. The master unit begins the routine by sending a group of data bits (a command) to the slave. These bits represent the measurement mode and direction of test (i.e., Level & Frequency, MASTER-TO-SLAVE). After the group of bits are received by the slave, the slave sends the same bit group back to the master. The master compares its originally transmitted message with its received message to check for proper reception.

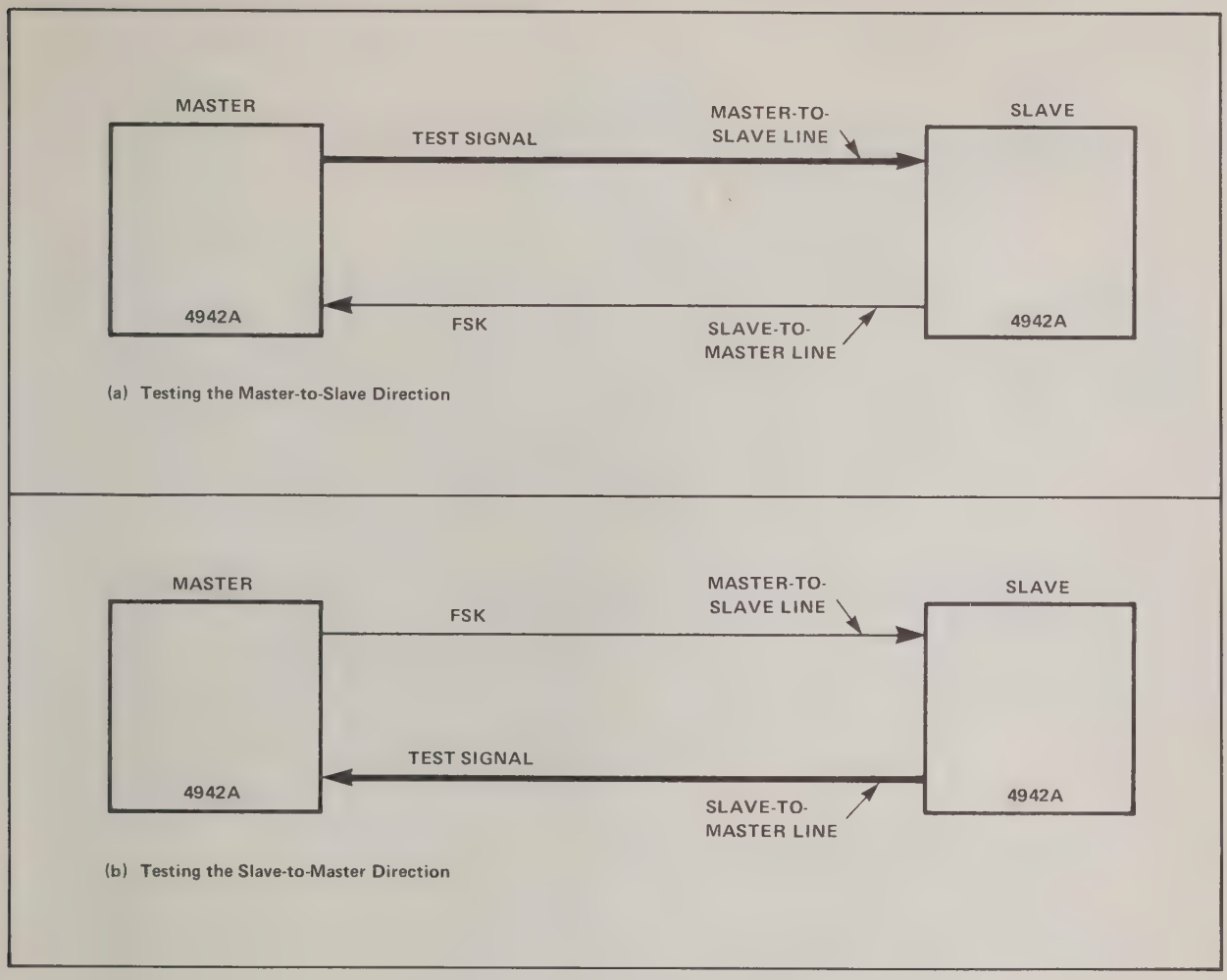


Figure 3-29. Direction of Test

3-94. DIRECTION OF TEST. There are two transmission paths between the master and slave units as shown in Figure 3-29. To test the path from master to slave, the REMOTE switch is set to the MASTER TO SLAVE position. The master then "tells" the slave that it will be receiving a test signal. The slave in turn will "talk" to the master to "tell" it the measured test values at the slave. The master will then display the test values measured by the slave.

3-95. Testing the opposite direction is accomplished by positioning the REMOTE switch to SLAVE TO MASTER. The master sends instructions to the slave unit on the master-to-slave path and measures the test signal sent from the slave.

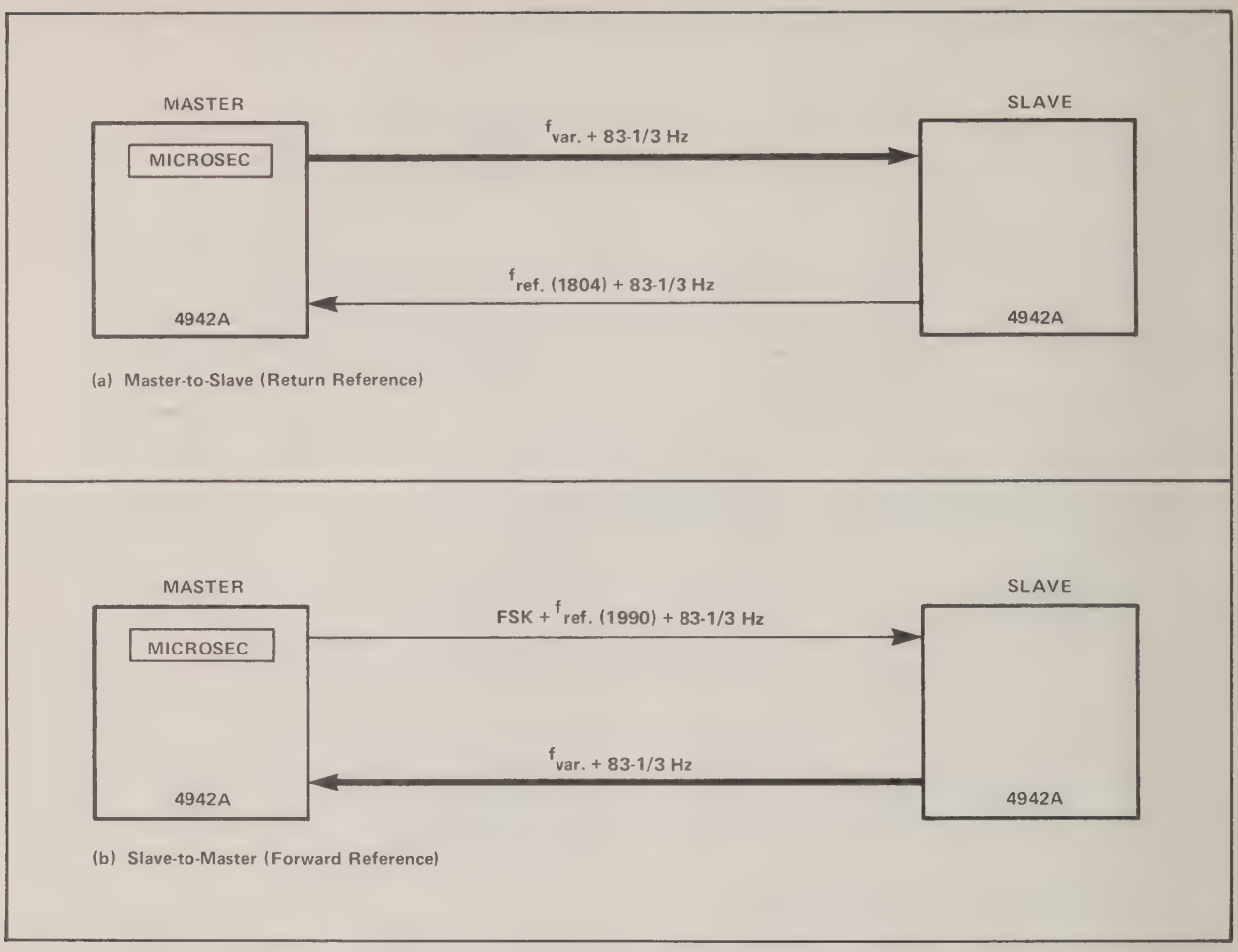


Figure 3-30. Envelope Delay Using Master-Slave

3-96. ENVELOPE DELAY OPERATION. Envelope delay distortion is measured using master-slave operation as shown in Figure 3-30. To begin the measurement, the two units perform the "handshake" routine as described previously. The master unit initially "tells" the slave unit to act as a repeat set. The master then sends down the variable frequency carrier with its 83-1/3 Hz modulation. The slave in turn repeats the 83-1/3 Hz modulation onto a fixed reference frequency of 1804 Hz. Envelope delay is then measured at the master unit.

3-97. To measure in the slave-to-master direction, the master unit sends a composite signal made up of:

FSK . . . . . 800 ⟷ 1200 Hz
$f_{reference}$ (FSK PILOT) . . . . . 1990 Hz
Modulation . . . . . .83-1/3 Hz

The FSK component is "telling" the slave unit to send back a particular carrier frequency. The presence of the 1990 Hz signal serves two purposes. First, it serves to "alert" the slave that FSK is arriving. Secondly, it serves as the fixed frequency carrier. The slave in turn repeats the 83-1/3 Hz onto its variable frequency carrier.

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. The procedures in this section test the instrument's electrical performance using the specifications of Table 1-1 as the performance standards. All tests can be performed without access to the interior of the instrument. A simpler operational test is provided in Section III under Self Check Procedures.

4-3. EQUIPMENT REQUIRED

4-4. Equipment required for the performance tests is listed in the Recommended Test Equipment table in Section I. Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended model(s).

4-5. TEST RECORD

4-6. Results of the performance tests may be tabulated on the Test Record at the end of these procedures. The Test Record lists all of the tested specifications and their acceptable limits. The results recorded at incoming inspection can be used for comparison in periodic maintenance, troubleshooting, and after repairs or adjustments.

4-7. CALIBRATION CYCLE

4-8. This instrument requires periodic verification of performance. Depending on use and environmental conditions, the instrument should be checked using the performance tests at least every six months. The performance tests may also be performed prior to any periodic calibration (suggested annually), to eliminate any unnecessary effort.

PERFORMANCE TESTS

> **NOTE**
>
> *Perform Self Check procedures (Figure 3-2) before proceeding with any Performance Tests. It is necessary to verify instrument functional operation with the Self Check procedures, before beginning with the Performance Tests. The Performance Tests then verify that the instrument meets published specifications.*

4-9. FREQUENCY RANGE TEST

SPECIFICATION:
Range: 200 Hz to 3950 Hz
Resolution: 1 Hz
Accuracy: ±0.5 Hz
SF Skip: 2450 Hz to 2750 Hz

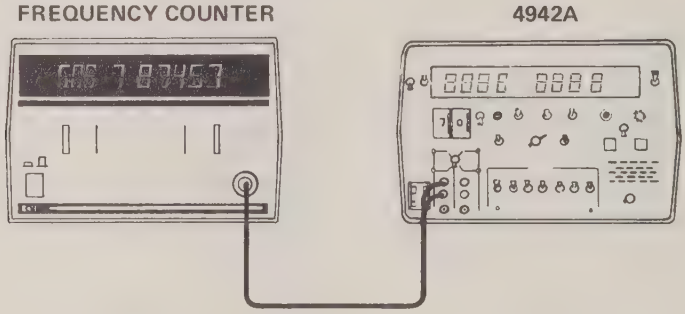


Figure 4-1. Frequency Range Test Setup

TEST EQUIPMENT REQUIRED: Frequency Counter.

SETUP CONDITIONS: 4942A

MEASUREMENT	LEVEL & FREQUENCY
DISPLAY TRMT/RCV	TRMT
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

PROCEDURE:

1. Adjust TRANSMITTER FREQUENCY to 204 Hz and TRANSMITTER OUTPUT LEVEL to +0.0 dBm. Verify that counter reads 204 ±0.5 Hz.

2. Adjust TRANSMITTER FREQUENCY to 3904 Hz. Verify that counter reads 3904 ±0.5 Hz.

3. Set the frequency control switch to MANUAL. Set the NO SF SKIP/SF SKIP switch to SF SKIP. Vary the TRANSMITTER FREQUENCY control through the frequency band. Verify a minimum frequency of 199 ±1 Hz, blank between 2450 ±1 Hz and 2750 ±1 Hz, and a maximum frequency of 3950 ±1 Hz.

4. Return all SETUP switches to UP position.

PERFORMANCE TESTS

4-10. OUTPUT LEVEL ACCURACY TEST

SPECIFICATION:
Range: +10 dBm to –40 dBm
Resolution: 0.1 dBm
Accuracy: ±0.1 dB
Frequency Response: ±0.1 dB from 200 Hz to 3904 Hz

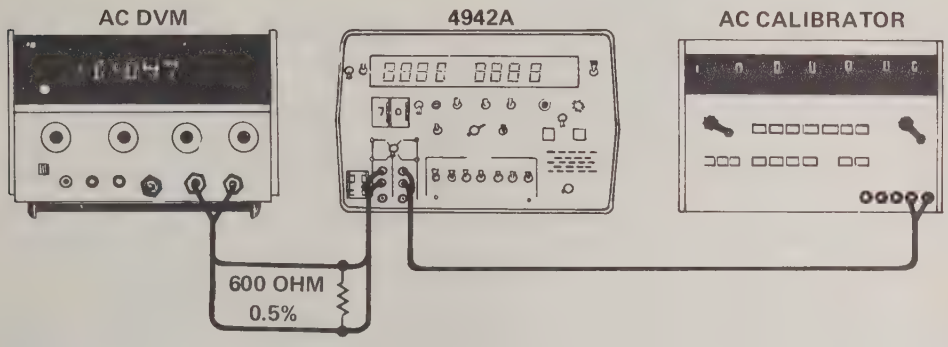


Figure 4-2. Output Level Accuracy Test Setup

TEST EQUIPMENT REQUIRED: AC Calibrator, AC DVM, 600 ohm resistor.

SETUP CONDITIONS: 4942A

MEASUREMENT	LEVEL & FREQUENCY
DISPLAY TRMT/RCV	TRMT
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

AC Calibrator

Frequency	1000 Hz
Amplitude	774.6 mVac

PROCEDURE:

1. Adjust TRANSMITTER FREQUENCY to 1004 Hz and TRANSMITTER OUTPUT LEVEL for AC DVM reading of 774.6 mVac. Left display must read +0.0 ±0.1 dBm.

2. Connect AC Calibrator to RCV jacks. Set DISPLAY TRMT/RCV switch to RCV. Select each output level shown and verify reading in the left display:

AC Calibrator output	Left Display reading
774.6 mVac	+0.0 ±0.1 dBm
690.4 mVac	–1.0 ±0.1 dBm
615.3 mVac	–2.0 ±0.1 dBm
548.4 mVac	–3.0 ±0.1 dBm
488.7 mVac	–4.0 ±0.1 dBm

4-10. OUTPUT LEVEL ACCURACY TEST (cont'd)

AC Calibrator output	Left Display reading
435.6 mVac	−5.0 ±0.1 dBm
388.2 mVac	−6.0 ±0.1 dBm
346.0 mVac	−7.0 ±0.1 dBm
308.4 mVac	−8.0 ±0.1 dBm
274.8 mVac	−9.0 ±0.1 dBm
244.9 mVac	−10.0 ±0.1 dBm
218.3 mVac	−11.0 ±0.1 dBm
194.6 mVac	−12.0 ±0.1 dBm
173.4 mVac	−13.0 ±0.1 dBm
154.6 mVac	−14.0 ±0.1 dBm
137.7 mVac	−15.0 ±0.1 dBm
122.8 mVac	−16.0 ±0.1 dBm
109.4 mVac	−17.0 ±0.1 dBm
97.52 mVac	−18.0 ±0.1 dBm
86.91 mVac	−19.0 ±0.1 dBm
77.46 mVac	−20.0 ±0.1 dBm
43.56 mVac	−25.0 ±0.2 dBm
24.49 mVac	−30.0 ±0.2 dBm
13.77 mVac	−35.0 ±0.2 dBm
1.377 Vac	+5.0 ±0.2 dBm
2.449 Vac	+10.0 ±0.2 dBm

PERFORMANCE TESTS

4-11. HARMONIC DISTORTION, SPURIOUS SIGNALS, AND BACKGROUND NOISE TEST

SPECIFICATION: Total Harmonic Distortion to 10 kHz: Greater than 50 dB below fundamental
Spurious Signals to 10 kHz: Greater than 50 dB below fundamental
Background Noise to 10 kHz: Less than –90 dBm

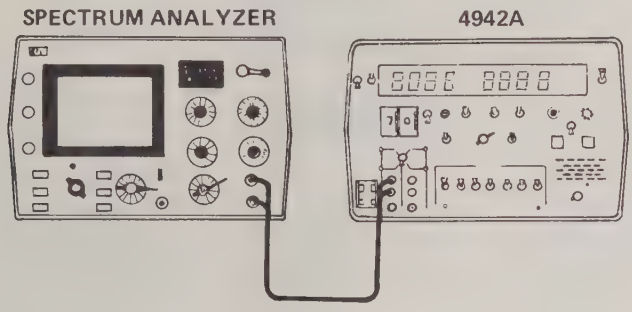


Figure 4-3. Harmonic Distortion, Spurious Signals, and Background Noise Test Setup

TEST EQUIPMENT REQUIRED: Spectrum Analyzer.

SETUP CONDITIONS: 4942A

MEASUREMENT	ENVELOPE DELAY
DISPLAY TRMT/RCV	TRMT
DISPLAY DELAY/LEVEL	LEVEL
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

Spectrum Analyzer

Input	600 ohm terminated

PROCEDURE:

1. Set TRANSMITTER FREQUENCY to 1004 Hz and TRANSMITTER OUTPUT LEVEL to –30 dBm.
2. Set spectrum analyzer to sweep the frequency range from 0-10 kHz. The fundamental at 1004 Hz will be accompanied by 83 Hz sidebands (at 921 Hz and 1087 Hz), which will be 12 dB down. The signals at 83 Hz and 3095 Hz should be 52 dB below the fundamental level. All other harmonics and spurious signals must be at least 46 dB below the fundamental. Particular frequencies to measure are 166 Hz, 2008 Hz, 3012 Hz, and 5020 Hz.
3. Set MEASUREMENT switch to LEVEL & FREQUENCY. The 83 Hz sidebands will disappear. All harmonics and spurious signals must be at least 50 dB below the fundamental.
4. Background noise must be less than –90 dBm.

PERFORMANCE TESTS

4-12. ACTIVE HOLD TEST

PERFORMANCE CHARACTERISTIC: 23 mA with external 48 Vdc source

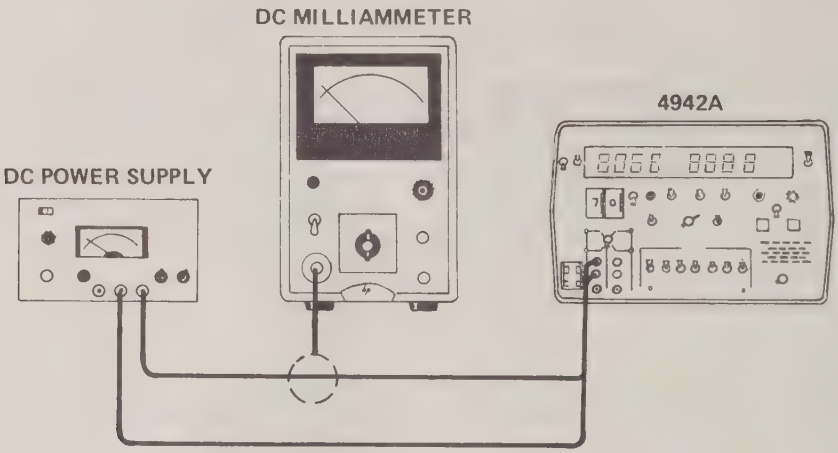


Figure 4-4. Active Hold Test Setup

TEST EQUIPMENT REQUIRED: DC Power Supply, DC Milliammeter.

SETUP CONDITIONS: 4942A

MEASUREMENT	LEVEL & FREQUENCY
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

PROCEDURE:

1. Adjust DC Power Supply to 48 Vdc. Check for DC Milliammeter reading of 0 mA.

2. Select TEST WITH HOLD. DC Milliammeter must read 23 ±1 mA.

Table 4-1. Performance Test Record (1 of 2)

Hewlett-Packard Model 4942A
Transmission Impairment Measuring Set
Serial No. _____ A- _____
4942A Passes Self Check ☐

Tested by _____
Repair Order No. _____
Date _____

Recommended 6 Month Interval

PARAGRAPH NUMBER	TEST	RESULTS		
		MINIMUM	ACTUAL	MAXIMUM
4-9	FREQUENCY RANGE TEST			
	204 Hz Test	203.5 Hz	_____	204.5 Hz
	3904 Hz Test	3903.5 Hz	_____	3904.5 Hz
	Minimum Frequency	198 Hz	_____	200 Hz
	SF Skip Start	2449 Hz	_____	2451 Hz
	SF Skip Stop	2749 Hz	_____	2751 Hz
	Maximum Frequency	3949 Hz	_____	3951 Hz
4-10	OUTPUT LEVEL ACCURACY TEST			
	Displayed Transmitter Output Level at 1004 Hz and 774.6 mVac	– 0.1 dBm	_____	+ 0.1 dBm
	Displayed Receiver Level (dBm) at AC Calibrator Output (mVac)			
	774.6 mVac	– 0.1 dBm	_____	+ 0.1 dBm
	690.4 mVac	– 1.1 dBm	_____	– 0.9 dBm
	615.3 mVac	– 2.1 dBm	_____	– 1.9 dBm
	548.4 mVac	– 3.1 dBm	_____	– 2.9 dBm
	488.7 mVac	– 4.1 dBm	_____	– 3.9 dBm
	435.6 mVac	– 5.1 dBm	_____	– 4.9 dBm
	388.2 mVac	– 6.1 dBm	_____	– 5.9 dBm
	346.0 mVac	– 7.1 dBm	_____	– 6.9 dBm
	308.4 mVac	– 8.1 dBm	_____	– 7.9 dBm
	274.8 mVac	– 9.1 dBm	_____	– 8.9 dBm
	244.9 mVac	–10.1 dBm	_____	– 9.9 dBm
	218.3 mVac	–11.1 dBm	_____	–10.9 dBm
	194.6 mVac	–12.1 dBm	_____	–11.9 dBm
	173.4 mVac	–13.1 dBm	_____	–12.9 dBm
	154.6 mVac	–14.1 dBm	_____	–13.9 dBm
	137.7 mVac	–15.1 dBm	_____	–14.9 dBm
	122.8 mVac	–16.1 dBm	_____	–15.9 dBm
	109.4 mVac	–17.1 dBm	_____	–16.9 dBm
	97.52 mVac	–18.1 dBm	_____	–17.9 dBm
	86.91 mVac	–19.1 dBm	_____	–18.9 dBm
	77.46 mVac	–20.1 dBm	_____	–19.9 dBm
	43.56 mVac	–25.2 dBm	_____	–24.8 dBm
	24.49 mVac	–30.2 dBm	_____	–29.8 dBm
	13.77 mVac	–35.2 dBm	_____	–34.8 dBm

Table 4-1. Performance Test Record (2 of 2)

PARAGRAPH NUMBER	TEST	RESULTS		
		MINIMUM	ACTUAL	MAXIMUM
4-10 (Continued)	1.377 Vac	+ 4.8 dBm	_____	+ 5.2 dBm
	2.449 Vac	+ 9.8 dBm	_____	+10.2 dBm
4-11	HARMONIC DISTORTION, SPURIOUS SIGNALS, AND BACKGROUND NOISE TEST			
	With Envelope Delay Transmit, 1004 Hz carrier and –30 dBm output:			
	83 Hz sidebands at 921 Hz and 1087 Hz are 12 dB down, or more, from 1004 Hz level	12 dB	_____	X
	Signals below the 1004 Hz level at:			
	83 Hz	52 dB	_____	X
	166 Hz	46 dB	_____	X
	2008 Hz	46 dB	_____	X
	3012 Hz	46 dB	_____	X
	3095 Hz	52 dB	_____	X
	5020 Hz	46 dB	_____	X
	With Level and Frequency Transmit, 1004 Hz:			
	All harmonics and spurious signals at least 50 dB below 1004 Hz level	50 dB	_____	X
	Background noise less than –90 dBm	X	_____	–90 dBm
4-12	ACTIVE HOLD TEST			
	Active Hold Off	X	_____	0 mA
	Active Hold On	22 mA	_____	24 mA

Note: "X" denotes meaningless data results.

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section contains complete field adjustment information for the 4942A Transmission Impairment Measuring Set. The adjustments provide a means for calibrating the instrument to published specifications as presented in Table 1-1. Included in this section are equipment setups and procedures. The adjustments are presented in the recommended order for a complete instrument calibration.

5-3. SAFETY REQUIREMENTS

5-4. The following precautions should be taken to insure against service person injury and instrument damage:

a. Remove ac power from the instrument when removing/installing instrument covers, when removing/installing PC boards, and when hooking up test equipment or test fixtures.

b. Use a properly grounded 3-wire receptacle for the instrument's power cord.

WARNING

Voltages at ac line potential are present at several points. Use extreme caution when making waveform and voltage measurements.

c. Read the adjustment procedure completely before performing it.

5-5. EQUIPMENT REQUIRED

5-6. Equipment required for the adjustments is listed in the Recommended Test Equipment table in Section I. Any equipment that satisfies the critical specifications given in the table may be substituted.

5-7. RELATED ADJUSTMENTS

5-8. It is seldom necessary to perform a complete adjustment procedure, except for possibly an annual calibration. However, it is necessary to perform certain adjustments after a PC board assembly is replaced (refer to Table 5-1), or when a component level repair is performed. A good check of an instrument's repair and/or adjustment is the self-check procedures as described in the Operation Section. Better yet is the performance tests as described in the Performance Tests Section.

5-9. ADJUSTMENT LOCATIONS

5-10. Adjustment locations are shown in Figure 5-14. This figure shows the location of all adjustments in the instrument.

5-11. CALIBRATION CYCLE

5-12. An annual calibration is suggested for best performance of the 4942A. An abbreviated calibration may be performed at six months, between the annual calibrations. This abbreviated calibration will maintain the instrument in top working order:

a. TRMT/RCV System Gain Adjustment, paragraph 5-14.

b. Detectors, Log Quantizer, C-Message Filter, and TRMT Output Adjustment, paragraph 5-16.

Table 5-1. Related Adjustments

ASSEMBLY CHANGED OR REPAIRED		PERFORM THE FOLLOWING RELATED ADJUSTMENTS	PARAGRAPH NUMBER
A8	Modem	Modem 800/1200 Hz Adjustment	5-24
A9	Filter Modulator	TRMT/RCV System Gain Adjustment	5-14
		Detectors, Log Quantizer, C-MSG Filter, and TRMT Output Adjustment	5-16
		Transmitter Spurious Signal Rejection Adjustment	5-19
A11	Output	TRMT/RCV System Gain Adjustment	5-14
		Detectors, Log Quantizer, C-MSG Filter, and TRMT Output Adjustment	5-16
A13	TRMT & LATCH	VCO Linearity Adjustment	5-17
A14	Envelope Delay	Envelope Delay Adjustment	5-20
A16	Holding Coil & Weighting Filter	TRMT/RCV System Gain Adjustment	5-14
		Detectors, Log Quantizer, C-MSG Filter, and TRMT Output Adjustment	5-16
		Active Hold Adjustment	5-22
A17	Notch Filter & Program. Amp.	TRMT/RCV System Gain Adjustment	5-14
		Detectors, Log Quantizer, C-MSG Filter, and TRMT Output Adjustment	5-16
		Noise-with-Tone Notch Filter Adjustment	5-23
A18	Detectors & Log Quantizer	TRMT/RCV System Gain Adjustment	5-14
		Slew Amplifier Zero Adjustment	5-15
		Detectors, Log Quantizer, C-MSG Filter, and TRMT Output Adjustment	5-16
		Impulse Noise Threshold Adjustment	5-21
A19	Freq. Tr. Loop	Pulse Width Matching Adjustment	5-18
A23	PWR SUP	Power Supply Adjustment	5-13

NOTE: An abbreviated calibration may be performed at six months, between the annual calibrations, as follows:

1. TRMT/RCV System Gain Adjustment, paragraph 5-14.
2. Detectors, Log Quantizer, C-MSG, and TRMT Output Adjustment, paragraph 5-16.

ADJUSTMENTS

5-13. POWER SUPPLY ADJUSTMENT

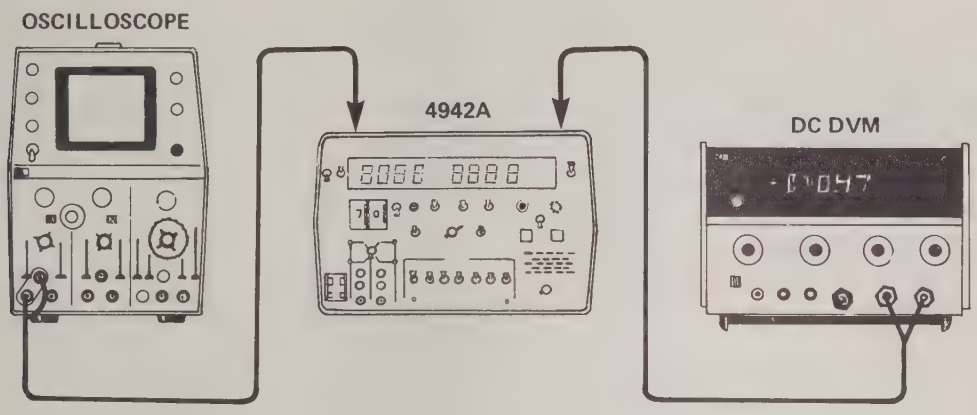


Figure 5-1. Power Supply Adjustment Test Setup

TEST EQUIPMENT REQUIRED: Oscilloscope, DC DVM, variable ac transformer, extender board.

PC BOARD AFFECTED: A23.

SETUP CONDITIONS: Remove A16 Assembly and reinstall on extender board.
Connect ac power cord through variable ac transformer to power source.

PROCEDURE:

1. Apply ac power to instrument and adjust ac line voltage to 117 Vac.
2. Connect DC DVM and oscilloscope (in parallel) to XA16-22 (HI) and chassis (LO).
3. Adjust A23R27 for DC DVM reading of +5.00 ±0.01 Vdc. Adjust variable ac transformer for ac line voltage of 105 Vac, then adjust to 129 Vac. The +5V supply should remain constant ±0.02 Vdc. Return ac line voltage to 117 Vac.
4. Using oscilloscope, measure the ac ripple content of the +5V supply. The ac ripple should not exceed 5 mV p-p.
5. Connect DC DVM and oscilloscope (in parallel) to XA16-20 (HI) and chassis (LO).
6. Adjust A23R37 for DC DVM reading of +15.00 ±0.01 Vdc. Adjust variable ac transformer for ac line voltage of 105 Vac, then adjust to 129 Vac. The +15V supply should remain constant ±0.05 Vdc. Return ac line voltage to 117 Vac.
7. Using oscilloscope, measure the ac ripple content of the +15V supply. The ac ripple should not exceed 10 mV p-p.
8. Connect DC DVM and oscilloscope (in parallel) to XA16-18 (HI) and chassis (LO).

(continued next page)

ADJUSTMENTS

5-13. POWER SUPPLY ADJUSTMENT (cont'd)

9. Adjust A23R44 for DC DVM reading of −15.00 ±0.01 Vdc. Adjust variable ac transformer for ac line voltage of 105 Vac, then adjust to 129 Vac. The −15V supply should remain constant ±0.05 Vdc. Return ac line voltage to 117 Vac.

10. Using oscilloscope, measure the ac ripple content of the −15V supply. The ac ripple should not exceed 10 mV p-p.

ADJUSTMENTS

5-14. TRMT/RCV SYSTEM GAIN ADJUSTMENT

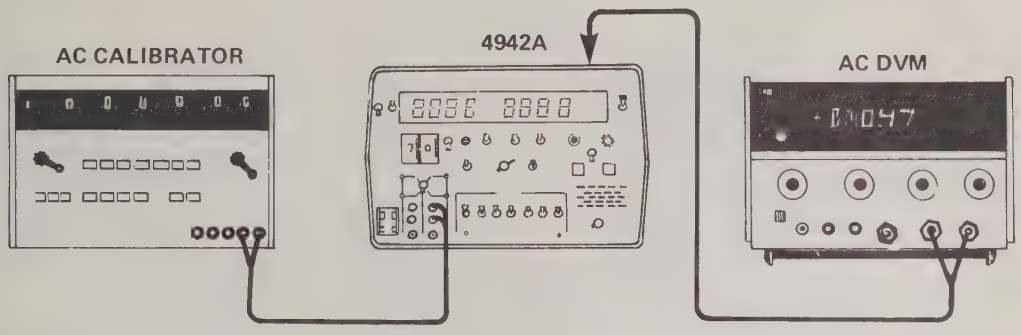


Figure 5-2. TRMT/RCV System Gain Adjustment Test Setup

TEST EQUIPMENT REQUIRED: AC Calibrator, AC DVM.

PC BOARDS AFFECTED: A11, A17.

SETUP CONDITIONS: 4942A

MEASUREMENT	LEVEL & FREQUENCY
DISPLAY TRMT/RCV	RCV
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

AC Calibrator

Frequency	1004 Hz
Amplitude	774.6 mVac

PROCEDURE:

1. Connect AC DVM to A17TP3 (HI) and chassis (LO).
2. Adjust A17R52 for AC DVM reading of 1.845 ±0.001 Vac. This adjustment sets overall receiver gain.
3. Disconnect AC Calibrator. Loop TRMT/RCV jacks. Adjust 4942A OUTPUT LEVEL for AC DVM reading of 1.845 ±0.001 Vac.
4. Select DISPLAY TRMT. Adjust A11R39 for AC DVM reading of 1.845 ±0.001 Vac. This adjustment matches the transmitter display to the receiver.

ADJUSTMENTS

5-15. SLEW AMPLIFIER ZERO ADJUSTMENT

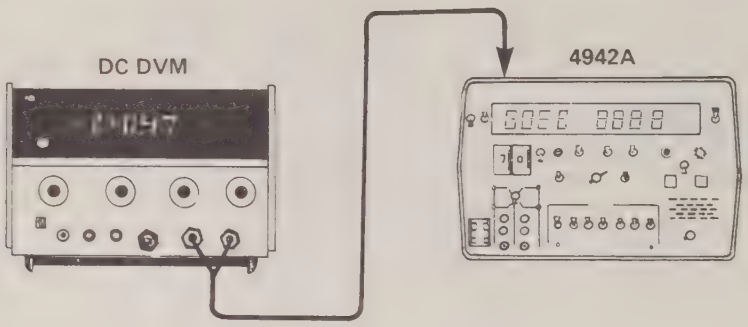


Figure 5-3. Slew Amplifier Zero Adjustment Test Setup

TEST EQUIPMENT REQUIRED: DC DVM, clip lead.

PC BOARD AFFECTED: A18.

SETUP CONDITIONS: 4942A

MEASUREMENT	IMPULSE NOISE
IMPULSE NOISE THRESHOLD	
DBRNC	100 DBRNC
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

Connect clip lead between A18TP1 and A18TP6.

PROCEDURE:

1. Connect DC DVM to A18TP1 (HI) and chassis (LO).
2. Adjust A18R5 for 0.000 ±0.003 Vdc.
3. Remove clip lead between A18TP1 and A18TP6.

ADJUSTMENTS

5-16. DETECTORS, LOG QUANTIZER, C-MESSAGE FILTER, AND TRMT OUTPUT ADJUSTMENT

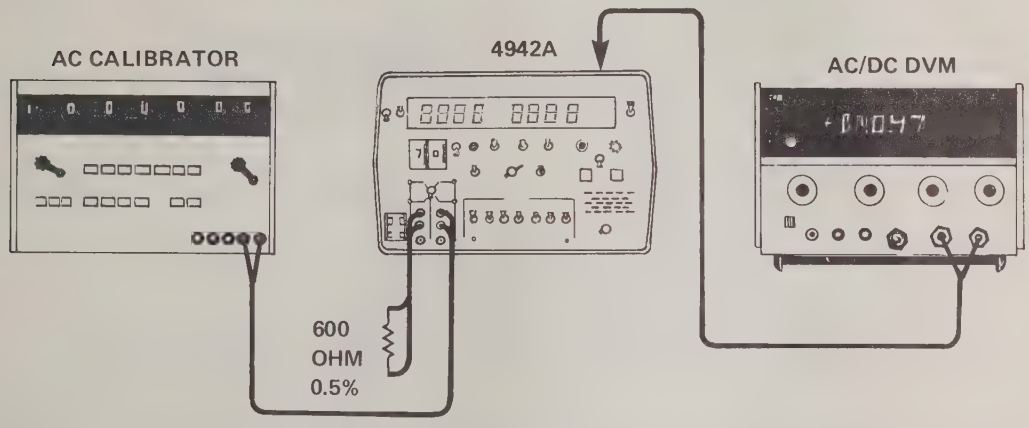


Figure 5-4. Detectors, Log Quantizer, C-Message Filter, and TRMT Output Adjustment Test Setup

TEST EQUIPMENT REQUIRED: AC Calibrator, AC/DC DVM, 600 ohm resistor.

PC BOARDS AFFECTED: A9, A16, A18.

SETUP CONDITIONS: 4942A

MEASUREMENT	LEVEL & FREQUENCY
DISPLAY TRMT/RCV	RCV
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

AC Calibrator

Frequency	1000 Hz
Amplitude	774.6 mVac

PROCEDURE:

1. Connect DC DVM to A18TP3 (HI) and chassis (LO).
2. Adjust A18R23 for DC DVM reading of +3.325 ±0.001 Vdc.
3. Disconnect DC DVM. With LEVEL ZERO switch depressed, switch to SELF-CHECK. This allows the microprocessor and display circuitry to measure log quantizer pulse width.
4. Adjust AC Calibrator amplitude to 244.9 mVac. Adjust A18R43 for a display of 0 μS on the left display (set to the point where display oscillates between 0 and 1 μS).

(continued next page)

ADJUSTMENTS

5-16. DETECTORS, LOG QUANTIZER, C-MESSAGE FILTER, AND TRMT OUTPUT ADJUSTMENT (cont'd)

5. Adjust AC Calibrator amplitude back to 774.6 mVac. Adjust A18R57 for a display of 1000 μS on the left display.

6. These two adjustments interact somewhat. Repeat steps 4 and 5. These adjustments set the exact width of a 10 dB "window".

7. Set MEASUREMENT switch to NOISE-WITH-TONE. Adjust A18R18 for a display of 1000 μS on the left display.

8. Set MEASUREMENT switch to SIGNAL-TO-NOISE. Adjust A16R11 for a display of 1000 μS on the left display.

9. Set AC Calibrator frequency to 3000 Hz. Adjust A16R50 for a display of 750 μS on the left display (corresponding to −2.5 dB at 3000 Hz).

10. These two adjustments interact somewhat. Repeat steps 8 and 9. These adjustments set the response curve of the C-Message Filter.

11. Set AC Calibrator frequency to 500 Hz. Verify left display reading of 250 ±50 μS at 500 Hz.

12. Connect AC DVM to TRMT jacks (in parallel with 600 ohm resistor).

13. Adjust A9R9 for AC DVM reading of 774.6 ±0.3 mVac.

14. Set NORMAL TEST/SELF-CHECK switch to NORMAL TEST. Set MEASUREMENT switch to C-MESSAGE NOISE, then back to LEVEL & FREQUENCY. This puts the left display back in the dBm mode.

ADJUSTMENTS

5-17. VCO LINEARITY ADJUSTMENT

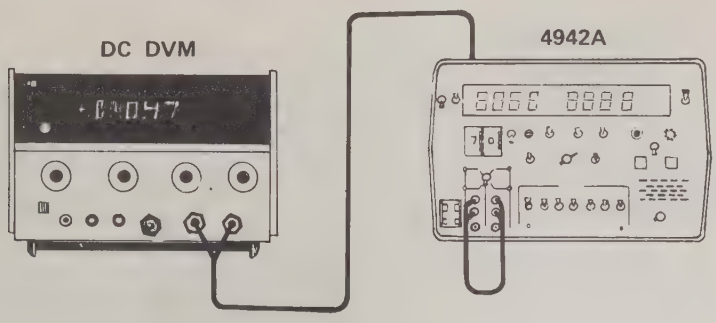


Figure 5-5. VCO Linearity Adjustment Test Setup

TEST EQUIPMENT REQUIRED: DC DVM, extender board.

PC BOARD AFFECTED: A13.

SETUP CONDITIONS: 4942A

MEASUREMENT	LEVEL & FREQUENCY
DISPLAY TRMT/RCV	RCV
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

Loop TRMT/RCV jacks. Adjust 4942A FREQUENCY to 204 Hz and OUTPUT LEVEL to +0.0 dBm.

Remove A13 Assembly and reinstall on extender board.

PROCEDURE:

1. Connect DC DVM to A13TP3 (HI) and chassis (LO).
2. Note DC DVM reading. Adjust 4942A FREQUENCY to 3904 Hz.
3. Adjust A13R49 for same DC DVM reading as that obtained in step 2.

ADJUSTMENTS

5-18. PULSE WIDTH MATCHING ADJUSTMENT

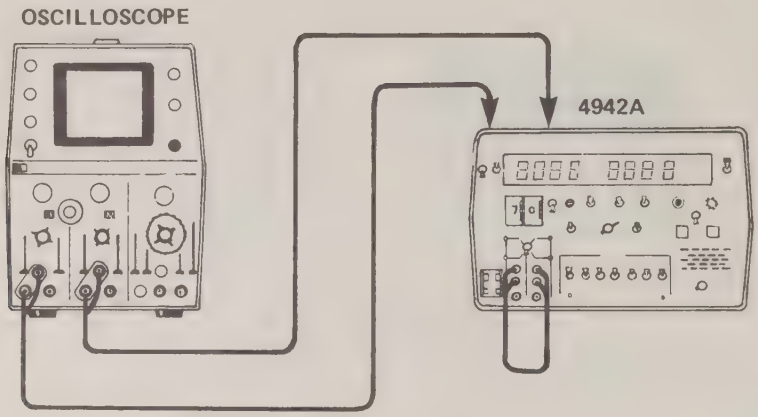


Figure 5-6. Pulse Width Matching Adjustment Test Setup

TEST EQUIPMENT REQUIRED: Oscilloscope, extender board.

PC BOARD AFFECTED: A19.

SETUP CONDITIONS: 4942A

MEASUREMENT	LEVEL & FREQUENCY
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

Oscilloscope

Vertical	0.5V/cm.
Horizontal	20 μS/div.
Mode	Alternate

Loop TRMT/RCV jacks. Adjust 4942A FREQUENCY to 1004 Hz and OUTPUT LEVEL to 0.0 dBm.

Remove A19 Assembly and reinstall on extender board.

PROCEDURE:

1. Connect CHAN A to XA19-C (HI) and chassis (LO). Connect CHAN B to XA19-6 (HI) and chassis (LO).

2. Adjust A19R23 for equal pulse widths on oscilloscope.

ADJUSTMENTS

5-19. TRANSMITTER SPURIOUS SIGNAL REJECTION ADJUSTMENT

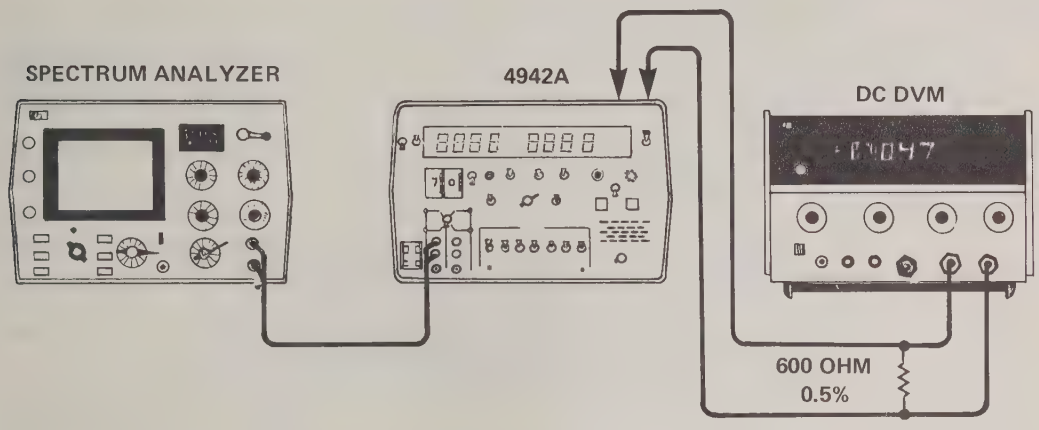


Figure 5-7. Transmitter Spurious Signal Rejection Adjustment Test Setup

TEST EQUIPMENT REQUIRED: Spectrum Analyzer, DC DVM, 600 ohm resistor, extender board.

PC BOARD AFFECTED: A9.

SETUP CONDITIONS: 4942A

MEASUREMENT	LEVEL & FREQUENCY
SETUP CONTROLS	UP
DELAY NORMAL/REPEAT	NORMAL
DISPLAY TRMT/RCV	TRMT
DISPLAY DELAY/LEVEL	LEVEL
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

Spectrum Analyzer

Input	600 ohm terminated
Frequency Span	20 kHz/div.

Remove A9 Assembly and reinstall on extender board.

Adjust 4942A FREQUENCY to 1004 Hz and OUTPUT LEVEL to –40.0 dBm.

(continued next page)

ADJUSTMENTS

5-19. TRANSMITTER SPURIOUS SIGNAL REJECTION ADJUSTMENT (cont'd)

PROCEDURE:

1. Connect DC DVM and 600 ohm resistor (in parallel) between XA9-E (HI) and chassis (LO).
2. Adjust A9R37 for 0.000 ±0.005 Vdc.
3. Disconnect DC DVM and 600 ohm resistor. Select ENVELOPE DELAY on MEASUREMENT switch.
4. Using the spectrum analyzer, search for the presence of a fundamental frequency 83 Hz tone (not 83 Hz sidebands).
5. Adjust A9R36 for minimum 83 Hz tone. Verify that all spurious signals are at least 50 dB below the fundamental tone.

ADJUSTMENTS

5-20. ENVELOPE DELAY ADJUSTMENT

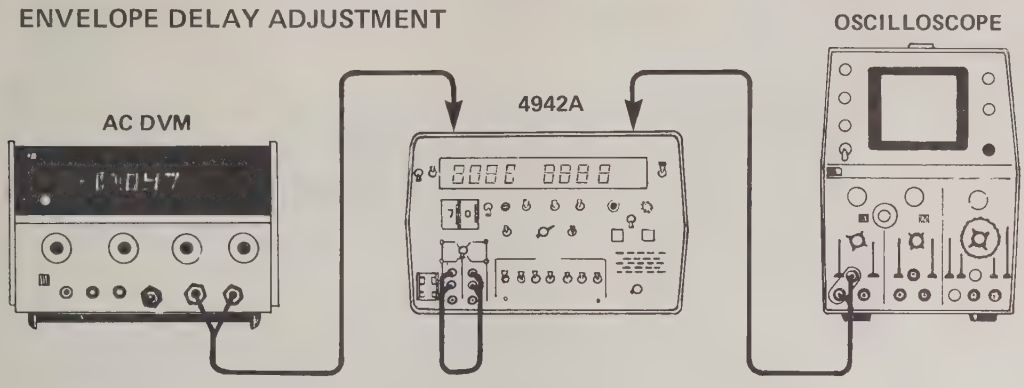


Figure 5-8. Envelope Delay Adjustment Test Setup

TEST EQUIPMENT REQUIRED: AC DVM, oscilloscope, extender board, clip lead.

PC BOARD AFFECTED: A14.

SETUP CONDITIONS: 4942A

MEASUREMENT	ENVELOPE DELAY
DISPLAY TRMT/RCV	TRMT
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

Loop TRMT/RCV jacks. Remove A14 Assembly and reinstall on extender board.

PROCEDURE:

1. Disconnect A14JU2 from N1 pin and reconnect to T1 pin.
2. Disconnect A14JU4 from N3 and connect clip lead between A14JU4-3 and A14JU2-T1.
3. Disconnect A14JU3 from N2 pin and reconnect to T2 pin.
4. Depress front panel DELAY ZERO switch.
5. Move clip lead from A14JU2-T1 to A14TP6.
6. Adjust A14R78 for front panel display of either −3000 ±30 or +9000 ±30 MICRO SEC.
7. Remove clip lead and connect A14JU4 to N3 pin.
8. Adjust A14R86 for a front panel display of +6000 ±30 MICRO SEC.

(continued next page)

ADJUSTMENTS

5-20. ENVELOPE DELAY ADJUSTMENT (cont'd)

PROCEDURE:

9. Disconnect A14JU4 from N3 and connect clip lead between A14JU4-3 and A14TP10. The display should read +3000 ±150 MICRO SEC. This checks the LO-Q filter phase shift.

10. Remove clip lead and connect A14JU4 to N3.

11. Depress front panel DELAY ZERO switch.

12. Disconnect A14JU3 from T2 and reconnect to N2. The automatic filter correction loop works if the display reads 0 ±150 MICRO SEC and if A14TP7 measures within +2.5 and +5 VDC.

13. Depress DELAY ZERO. The display should read 0 MICRO SEC.

14. Disconnect A14JU2 from T1 and reconnect to N1.

15. Connect oscilloscope to A14TP6 (HI) and chassis (LO).

16. Adjust A14R20 for 3.9V p-p amplitude on oscilloscope.

ADJUSTMENTS

5-21. IMPULSE NOISE THRESHOLD ADJUSTMENT

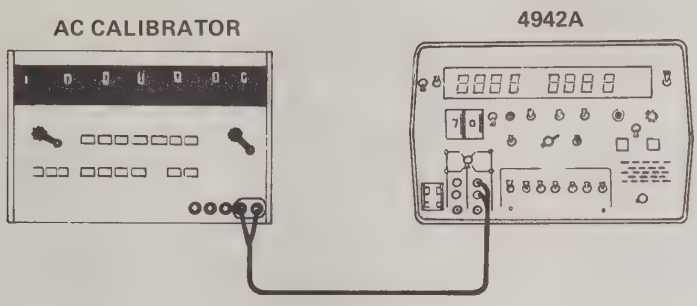


Figure 5-9. Impulse Noise Threshold Adjustment Test Setup

TEST EQUIPMENT REQUIRED: AC Calibrator (or audio oscillator and AC DVM).

PC BOARD AFFECTED: A18.

SETUP CONDITIONS: 4942A

MEASUREMENT	IMPULSE NOISE
IMPULSE NOISE THRESHOLD	
DBRNC	93 DBRNC
DISPLAY TRMT/RCV	RCV
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

AC Calibrator

Frequency	2000 Hz
Amplitude	774.6 mVac

PROCEDURE:

1. Disconnect input to RCV jacks.
2. Depress START RESET switch. Wait 10 seconds, then reconnect input to RCV jacks.
3. Adjust A18R31 to the point where the right display just begins to count.

ADJUSTMENTS

5-22. ACTIVE HOLD ADJUSTMENT

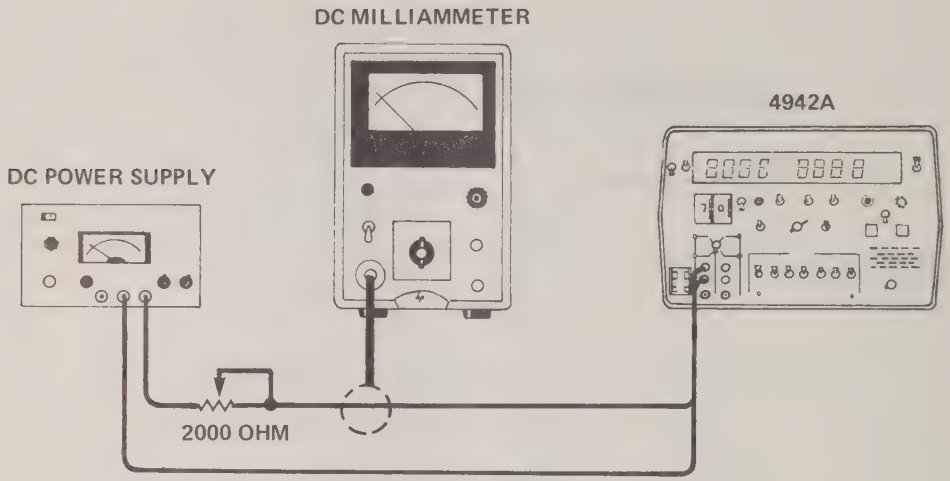


Figure 5-10. Active Hold Adjustment Test Setup

TEST EQUIPMENT REQUIRED: DC Power Supply, DC Milliammeter, 2000 ohm, 2W potentiometer.

PC BOARD AFFECTED: A16.

SETUP CONDITIONS: 4942A

MEASUREMENT	LEVEL & FREQUENCY
SETUP CONTROLS	UP, except select TEST WITH HOLD
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

PROCEDURE:

1. Set potentiometer to 1700 ohms. Adjust DC Power Supply to 46 Vdc.
2. Adjust A16R41 for 23 mA reading on DC Milliammeter.
3. Set potentiometer to 400 ohms. Adjust DC Power Supply to 53 Vdc. Verify that current is $\leqslant$ 40 mA.
4. Set potentiometer to 0 ohms. Adjust DC Power Supply to 7 Vdc. Verify that current is $\geqslant$ 23 mA.
5. Leaving potentiometer at 0 ohms, adjust DC Power Supply to 5 Vdc. Verify that current is $<$5 mA.

ADJUSTMENTS

Note: This adjustment need not be made as a periodic calibration step. Perform only when necessary, such as after component repair on affected circuitry.

5-23. NOISE-WITH-TONE NOTCH FILTER ADJUSTMENT

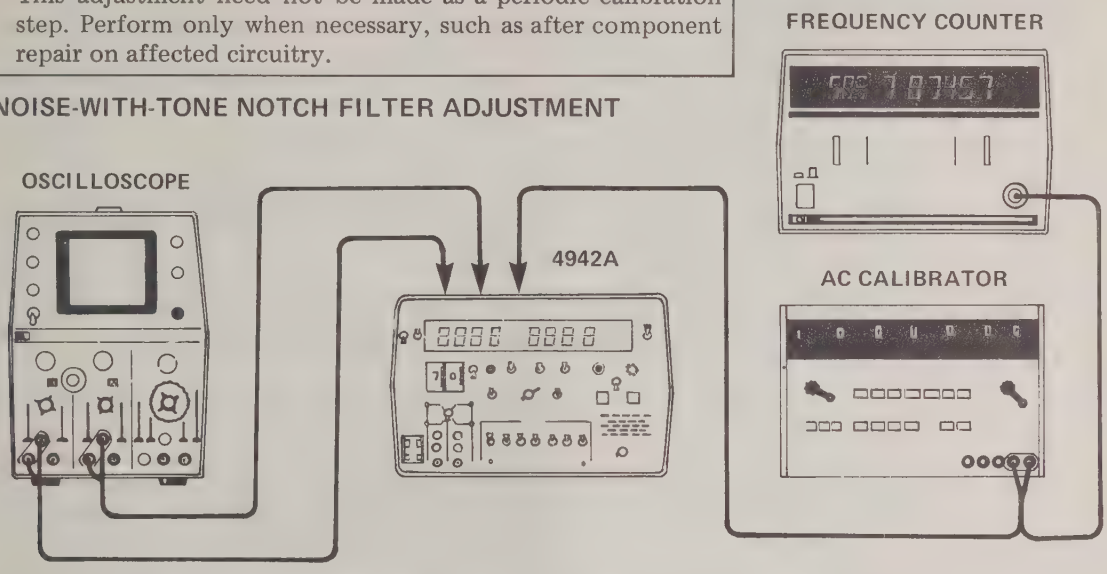


Figure 5-11. Noise-with-Tone Notch Filter Adjustment Test Setup

TEST EQUIPMENT REQUIRED: AC Calibrator (or audio oscillator and AC DVM), oscilloscope, frequency counter, extender board.

PC BOARD AFFECTED: A17.

SETUP CONDITIONS:

4942A

MEASUREMENT	LEVEL & FREQUENCY
DISPLAY TRMT/RCV	RCV
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

AC Calibrator

Frequency	1010 Hz
Amplitude	244.9 mVac

Oscilloscope

Vertical — CHAN A	0.5V/cm
Vertical — CHAN B	0.5V/cm
Mode	A vs. B

Note: Use 1:1 probes, or better yet, use straight-thru cables.

Remove A17 Assembly and reinstall on extender board.

PROCEDURE:

1. Disconnect coax cable between A6 and A17 assemblies. Connect CHAN A to A17J1 (in parallel with AC Calibrator). Connect CHAN B to A17J3-7 (HI) and chassis (LO).

(continued next page)

ADJUSTMENTS

5-23. NOISE-WITH-TONE NOTCH FILTER ADJUSTMENT (cont'd)

2. Adjust AC Calibrator frequency to 1010 Hz. Adjust oscilloscope for a lissajous pattern (depending on how close the adjustment is, this could be either a line from upper left to lower right, a circle, or something in between).

3. Adjust A17R4 for a straight line from upper left to lower right (corresponding to a 180° phase shift).

4. Connect CHAN B to A17J3-8 (HI) and chassis (LO). Adjust AC Calibrator frequency to 892 Hz. Adjust oscilloscope for a lissajous pattern.

5. Adjust A17R6 for a straight line from upper left to lower right (corresponding to a 180° phase shift).

6. Connect CHAN A to A17J3-6 (in parallel with AC Calibrator). Connect CHAN B to A17J3-5 (HI) and chassis (LO). Adjust AC Calibrator frequency to 1010 Hz. Adjust oscilloscope for a lissajous pattern.

7. Adjust A17R14 for a straight line from upper right to lower left (corresponding to a 0° phase shift).

8. Connect CHAN B to A17J3-2 (HI) and chassis (LO). Adjust AC Calibrator frequency to 840 Hz. Adjust oscilloscope for a lissajous pattern.

9. Adjust A17R16 for a straight line from upper right to lower left (corresponding to a 0° phase shift).

10. Connect CHAN A to A17J3-1 (in parallel with AC Calibrator). Connect CHAN B to A17J3-4 (HI) and chassis (LO). Adjust AC Calibrator frequency to 1010 Hz. Adjust oscilloscope for a lissajous pattern.

11. Adjust A17R24 for a straight line from upper right to lower left (corresponding to a 0° phase shift).

12. Connect CHAN B to A17J3-3 (HI) and chassis (LO). Adjust AC Calibrator frequency to 1260 Hz. Adjust oscilloscope for a lissajous pattern.

13. Adjust A17R26 for a straight line from upper left to lower right (corresponding to a 180° phase shift).

ADJUSTMENTS

> Note: This adjustment need not be made as a periodic calibration step. Perform only when necessary, such as after component repair on affected circuitry.

5-24. MODEM 800/1200 Hz ADJUSTMENT

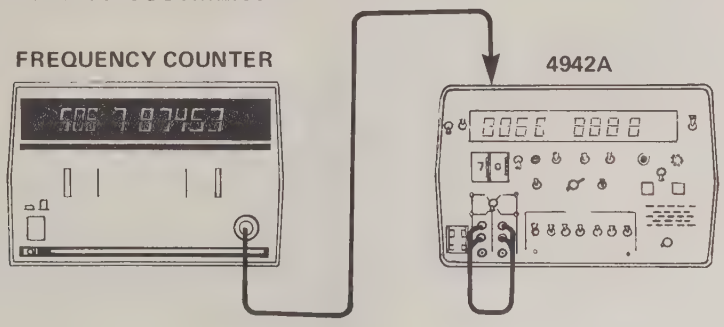


Figure 5-12. Modem 800/1200 Hz Adjustment Test Setup

TEST EQUIPMENT REQUIRED: Frequency Counter, extender board, clip lead.

PC BOARD AFFECTED: A8.

SETUP CONDITIONS: 4942A

MEASUREMENT	LEVEL & FREQUENCY
SETUP CONTROLS	UP
TRMT/RCV JACKS	Left jack field TRMT Right jack field RCV

Loop TRMT/RCV jacks. Remove A8 Assembly and reinstall on extender board.

PROCEDURE:

1. With DELAY ZERO switch depressed, switch to SELF CHECK.
2. Connect frequency counter to XA8-10 (HI) and chassis (LO). Connect clip lead between XA8-S and XA8-1.
3. Adjust A8R7 for frequency counter reading of 800 ±2 Hz.
4. Reconnect clip lead between XA8-S and XA8-22.
5. Adjust A8R9 for frequency counter reading of 1200 ±2 Hz.
6. Remove clip lead between XA8-S and XA8-22.

ADJUSTMENTS

Note: This adjustment need not be made as a periodic calibration step. Perform only when necessary, such as after component repair on affected circuitry.

5-25. IMPULSE NOISE COUNT-RATE ADJUSTMENT

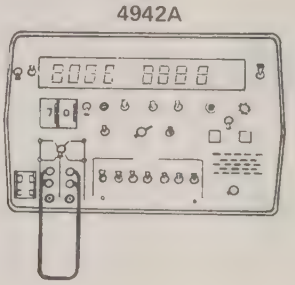


Figure 5-13. Impulse Noise Count-Rate Adjustment Test Setup

TEST EQUIPMENT REQUIRED: None.

PC BOARD AFFECTED: A18.

SETUP CONDITIONS: 4942A
SETUP CONTROLS. . . . . UP
Loop TRMT/RCV jacks.

PROCEDURE:

1. Start self check by moving NORMAL TEST/SELF CHECK switch to SELF CHECK.

2. Observe COUNTS accumulated in right display during the impulse noise test.

3. Select a value for A18R35 to give 70 ±2 COUNTS. The list below gives the recommended resistor values to select.

   Note: A bigger resistor gives less counts; a smaller resistor gives more counts.

Resistor Value	HP Part Number
576K	0698-7803
590K (nominal value)	0698-8343
604K	0698-8344

If the above resistor selection will not put the COUNTS into range, then replace A18U11, the 143 mS timer, and/or A18C19.

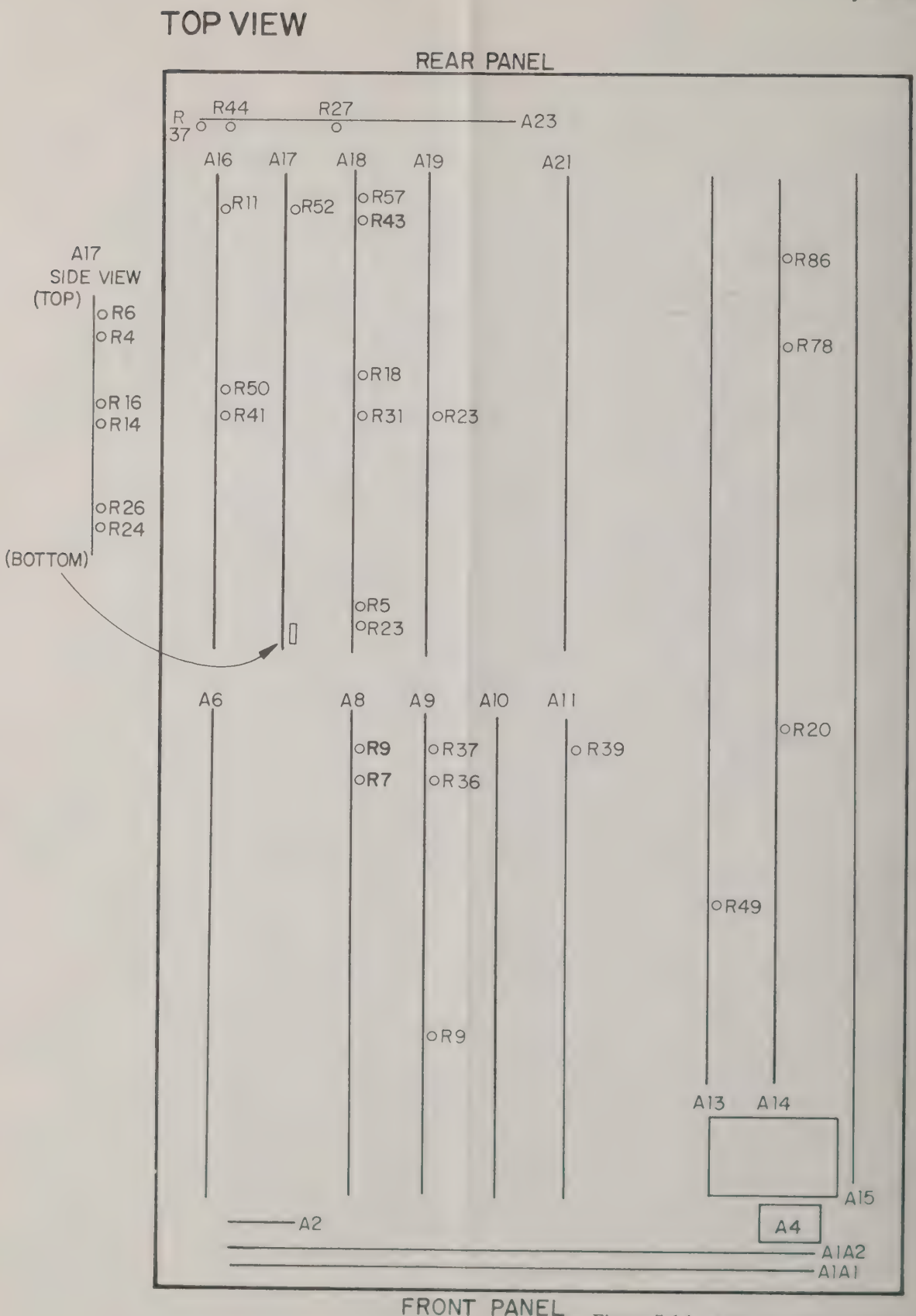


Figure 5-14. Adjustment Locations

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SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering parts. Table 6-1 is a list of new and exchange assemblies, and Table 6-2 lists abbreviations used in the parts list. Table 6-3 lists all replaceable parts in reference designator order.

6-3. NEW AND EXCHANGE ASSEMBLIES

6-4. Table 6-1 lists all replaceable assemblies in the Model 4942A. Listed in this table are the new assembly part numbers, and exchange part numbers, where appropriate. Exchange, factory repaired and tested assemblies are available only on a trade-in basis; therefore, the defective assemblies must be returned for credit. For this reason, assemblies required for spare parts stock must be ordered by the new assembly part number.

6-5. REPLACEABLE PARTS LIST

6-6. Table 6-3 is the list of replaceable parts and is organized as follows:

a. Electrical assemblies and their components in alphanumeric order by reference designation.

b. Chassis mounted electrical parts in alphanumeric order by reference designation.

c. Mechanical parts in reference designator order, along with a.parts location drawing.

6-7. The information given for each part consists of the following:

a. The Hewlett-Packard part number.

b. The total quantity used in the instrument.

c. The description of the part.

d. A typical manufacturer of the part as a five digit code.

e. The manufacturer's number for the part.

6-8. Table 6-4 contains a cross reference list between manufacturer's code and actual name and address.

Table 6-1. New and Exchange Replaceable Assembly Part Numbers

REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER	
		EXCHANGE ASSY	NEW ASSY
A1	Display PC Bd Assy	–	04942-60001
A2	Thumbwheel Switch PC Bd Assy	–	04942-60002
A3	Switch PC Bd Assy	–	04942-60003
A4	Monitor Amplifier PC Bd Assy	–	04942-60004
A5	Mother PC Bd Assy	–	04942-60005
A6	Input PC Bd Assy	–	04942-60006
A8	Modem PC Bd Assy	–	04942-60008
A9	Filter Modulator PC Bd Assy	–	04942-60009
A10	Transmit Control PC Bd Assy	–	04942-60010
A11	Output PC Bd Assy	–	04942-60011
A13	Transmitter & Latch PC Bd Assy	–	04942-60013
A14	Envelope Delay PC Bd Assy	–	04942-60014
A15	Microprocessor PC Bd Assy	04942-61015	04942-60015
A16	Holding Coil & Weighting Filters PC Bd Assy	–	04942-60016
A17	Notch Filter & Programmable Amp PC Bd Assy	–	04942-60017
A18	Detectors & Log Quantizer PC Bd Assy	–	04942-60018
A19	Frequency Tracking Loop PC Bd Assy	–	04942-60019
A21	HP-IB PC Bd Assy (used w/opt 010 only)	–	04942-60021
A23	Power Supply PC Bd Assy	–	04942-60023
A24	HP-IB Connector Assy (used w/opt 010 only)	–	04942-60024

Table 6-2. Reference Designations and Abbreviations (1 of 2)

REFERENCE DESIGNATIONS

A = assembly	JU = jumper	U = integrated circuit, non-repairable assembly
B = motor, synchro, fan	K = relay	V = vacuum tube, photocell, etc.
BP = binding post	L = inductor	VR = voltage regulator
BT = battery	M = meter	W = jumper wire, cable assembly
C = capacitor	OE = optical encoder	X = socket
CB = circuit breaker	P = plug connector	Y = crystal
CR = diode	Q = transistor	Z = tuned cavity, network
DL = delay line	R = resistor	
DS = indicator, display	RT = thermistor	
E = Misc electrical parts	S = switch	
F = fuse	T = transformer	
FL = filter	TB = terminal board	
J = receptacle connector, jack	TP = test point	

ABBREVIATIONS

A = amperes	DIA = diameter	K = kilo (10^3), kilohm
AC = alternating current	DIP = dual in-line package	
ADD = address	DPDT = double-pole, double-throw	LED = light emitting diode
ADJ = adjust, adjustment	DPST = double-pole, single-throw	LFT = left
AL = aluminum	DR = drive	LG = long
AR = as required	DRVR = driver	LH = left hand
ASM = algorithmic state machine	DSPL = display	LKWR = lockwasher
ASSY = assembly	DTL = diode-transistor logic	LP = low pass
		LS = low power Schottky
B = base	E = emitter	LSB = least significant bit
BCD = binary coded decimal	ECL = emitter-coupled logic	
BeCu = beryllium copper	ELECT = electrolytic	M = milli (10^{-3}), male, mega (10^6), megohm
BIN = binary	ENCAP = encapsulated	
BLK = black	EXT = external	MET FLM = metal film
BLU = blue	EXTR = extractor	MET OX. = metal oxide
BP = band pass		MHZ = megahertz
BRN = brown	F = female, farads	MFR = manufacturer
BRS = brass	FF = flip-flop	MINTR = miniature
BTU = British thermal unit	FLM = film	MISC = miscellaneous
	FRNT = front	MOM = momentary
C = collector	FXD = fixed	MOS = metal oxide semiconductor
CATH = cathode		MSB = most significant bit
CCW = counterclockwise	G = giga (10^9)	MTCHD = matched
CD PL = cadmium plate	GE = germanium	MTG = mounting
CER = ceramic	GL = glass	MTLC = metallic
CERMET = ceramic met flm	GND = ground(ed)	
CKTS = circuits	GP = General Purpose	N = nano (10^{-9})
C FLM = carbon film	GRA = gray	N.C. = normally closed, no connection
CLK = clock	GRN = green	
CLR = clear		NE = neon
CMOS = complementary metal oxide semiconductor logic	H = henries	NO. = number
	HDW = hardware	N.O. = normally open
COM = common	HEX = hexagon, hexagonal, six	NP = No Polarity
COML = commercial	HP = high pass	NPN = negative-positive-negative
COMP = composition	HR = hour(s)	NPO = negative-positive zero (zero temperature coefficient)
COMPL = complete	HZ = Hertz	
COND = conductor		NRFR = not recommended for field replacement
CONN = connector	IC = integrated circuit	
CONT = contact	ID = inside diameter	NS = normally shorting, nanosecond
CPRSN = compression	IF = intermediate frequency	
CTL = complementary-transistor logic	IN. = inch, inches	NSR = not separately replaceable
	INCAND = incandescent	NYL = nylon
CW = clockwise	INCL = include(s)	
	INSUL = insulation, insulated	OBD = order by description
D = diameter	INT = internal	OD = outside diameter
DC = direct current	INTL = internal	ORN = orange
DEPC = deposited carbon		

Table 6-2. Reference Designations and Abbreviations (2 of 2)

ABBREVIATIONS

P = pico (10^{-12})	RVT = rivet	TRN = turn
PC = printed circuit	RWV = reverse working voltage	TTL = transistor-transistor logic
PCA = printed-circuit assembly		TYP = typical
PF = picofarad	S = second	
PIV = Peak Inverse Voltage	SB = slow blow	U (μ) = micro (10^{-6})
PK = peak	SCR = silicon controlled rectifier	UF = microfarad
PNL = panel	SE = selenium	US = microseconds
PNP = positive-negative-positive	SGL = single	
P-P = peak-to-peak	SI = silicon	V = volt(s)
PPM = parts per million	SHK = shank	VAR = variable
POLYC = polycarbonate	SIP = single in-line package	VCO = voltage controlled oscillator
POLYE = polyethylene	SKT = socket	
POLYSTY = polystyrene	SLDR = solder	VDCW = direct current working volts
PORC = porcelain	SPCG = spacing	VIO = violet
POSN = position(s)	SPDT = single-pole, double-throw	VNP = no polarity voltage
POZI = pozidrive	SPST = single-pole, single-throw	
PRV = peak reverse voltage	SST = stainless-steel	W = watts
PWV = peak working voltage	STL = steel	WT = weight
P/O = part of	SZ = size	WW = wirewound
		WHT = white
R = ring	T = tip	WIP = wiper
RAM = random access memory	TA = tantalum	WIV = working inverse voltage
ROM = read only memory	TEL = telephone	WSHR = washer
RECT = rectifier	T.C. = Temp. Compensated, temp. coefficient	X = times, multiple
RF = radio frequency		
RH = right hand	THKNS = thickness	
RMS = root-mean-square	TI = titanium	YEL = yellow
RND = round	TGL = toggle	
RT = right hand	THD = thread	ZNR = zener
RTL = resistor-transistor logic	THK = thick	
RTNT = retainer	TOL = tolerance	ϕ = phi, phase
RTRY = rotary	TRMR = trimmer	

Table 6-3. Replaceable Parts (1 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	04942-60001	1	DISPLAY PC BOARD ASSEMBLY	28480	04942-60001
A1A1	No Number		DISPLAY & ANNUNCIATOR (NSP, P/O A1)		
A1A1C1	0180-1746	12	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A1A1CR1	1990-0547	22	LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR2	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR3	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR4	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR5	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR6	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR7	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR8	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR9	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR10	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR11	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR12	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR13	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR14	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR15	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR16	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR17	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR18	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR19	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR20	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR21	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1CR22	1990-0547		LED-VISIBLE LUM-INT=2MCD IF=20MA-MAX	28480	1990-0547
A1A1DS1	1990-0539	1	DISPLAY-NUM SEG .5-CHAR .408-H	28480	1990-0539
A1A1DS2	1990-0540	8	DISPLAY-NUM SEG 1-CHAR .43-H	28480	1990-0540
A1A1DS3	1990-0540		DISPLAY-NUM SEG 1-CHAR .43-H	28480	1990-0540
A1A1DS4	1990-0540		DISPLAY-NUM SEG 1-CHAR .43-H	28480	1990-0540
A1A1DS5	1990-0540		DISPLAY-NUM SEG 1-CHAR .43-H	28480	1990-0540
A1A1DS6	1990-0540		DISPLAY-NUM SEG 1-CHAR .43-H	28480	1990-0540
A1A1DS7	1990-0540		DISPLAY-NUM SEG 1-CHAR .43-H	28480	1990-0540
A1A1DS8	1990-0540		DISPLAY-NUM SEG 1-CHAR .43-H	28480	1990-0540
A1A1DS9	1990-0540		DISPLAY-NUM SEG 1-CHAR .43-H	28480	1990-0540
A1A1MP1	0380-0655	4	SPACER-SNP-IN .44 IN EFFECTIVE LG; LKG	28480	0380-0655
A1A1MP2	0380-0655		SPACER-SNP-IN .44 IN EFFECTIVE LG; LKG	28480	0380-0655
A1A1MP3	0380-0655		SPACER-SNP-IN .44 IN EFFECTIVE LG; LKG	28480	0380-0655
A1A1MP4	0380-0655		SPACER-SNP-IN .44 IN EFFECTIVE LG; LKG	28480	0380-0655
A1A1MP5	4040-1044	2	HOUSING, ANNUNCIATOR	28480	4040-1044
A1A1MP6	4040-1044		HOUSING, ANNUNCIATOR	28480	4040-1044
A1A1MP7	7120-5267	1	MASK, ANNUNCIATOR	28480	7120-5267
A1A1R1	0698-3442	3	RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A1A1R2	0698-3442		RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A1A1XDS1	1200-0474	11	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A1A1XDS2	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A1A1XDS3	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A1A1XDS4	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A1A1XDS5	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A1A1XDS6	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A1A1XDS7	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A1A1XDS8	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A1A1XDS9	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A1A2	No Number		DISPLAY DECODER & DRIVER (NSP, P/O A1)		
A1A2C1	0160-0161	4	CAPACITOR-FXD .01UF +-10% 200WVDC POLYE	56289	292P10392
A1A2C2	0160-0161		CAPACITOR-FXD .01UF +-10% 200WVDC POLYE	56289	292P10392
A1A2C3	0140-0193	4	CAPACITOR-FXD 82PF +-5% 300WVDC MICA	72136	DM15E820J0300WV1CR
A1A2C4	0140-0193		CAPACITOR-FXD 82PF +-5% 300WVDC MICA	72136	DM15E820J0300WV1CR
A1A2C5	0140-0193		CAPACITOR-FXD 82PF +-5% 300WVDC MICA	72136	DM15E820J0300WV1CR
A1A2C6	0140-0193		CAPACITOR-FXD 82PF +-5% 300WVDC MICA	72136	DM15E820J0300WV1CR
A1A2C7	0180-0104	4	CAPACITOR-FXD 200UF+75-10% 16VDC AL	56289	30D207G016DF2
A1A2C8	0180-0374	43	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A1A2J1	1251-3119	1	CONNECTOR 20-PIN M RECTANGULAR	76381	3428-2002
A1A2J2	1251-3305	1	CONNECTOR 4-PIN M POST TYPE	27264	09-65-1041(2244-4A)
A1A2JU1	1251-4268	2	CONT-SET, 20-PIN	28480	1251-4268
A1A2JU2	1251-4268		CONT-SET, 20-PIN	28480	1251-4268
A1A2P2	1251-3277	1	CONNECTOR 4-PIN F POST TYPE	27264	09-50-7041
A1A2P2	1251-3073	10	CONTACT-CONN FEM CRP	27264	08-50-0107

Table 6-3. Replaceable Parts (2 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A2R1	0757-0443	8	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A1A2R2	0757-0461	6	RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A1A2R3	1810-0246	1	NETWORK-RES 16-PIN-DIP .1-PIN-SPCG	11236	761
A1A2R4	1810-0247	1	NETWORK-RES 16-PIN-DIP .1-PIN-SPCG	11236	761
A1A2R5	1810-0248	1	NETWORK-RES 16-PIN-DIP .1-PIN-SPCG	11236	761
A1A2R6	0698-0083	6	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1A2R7	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1A2R8	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1A2R9	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1A2R10	1810-0223	12	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	56289	216CM-126-CRR
A1A2R11	1810-0223		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	56289	216CM-126-CRR
A1A2R12	1810-0135	6	NETWORK-RES 6-PIN-SIP .15-PIN-SPCG	28480	1810-0135
A1A2R13	1810-0135		NETWORK-RES 6-PIN-SIP .15-PIN-SPCG	28480	1810-0135
A1A2R14	0757-0465	50	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A1A2R15	0757-0316	15	RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A1A2R16	0757-0316		RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A1A2R17	0757-0316		RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A1A2R18	0757-0316		RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A1A2R19	0757-0316		RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A1A2R20	0757-0316		RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A1A2R21	0757-0316		RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A1A2R22	0757-0316		RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A1A2R23	0757-0316		RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A1A2R24	0757-0316		RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A1A2R25	0757-0316		RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A1A2R26	0757-0316		RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A1A2R27	0757-0316		RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A1A2R28	0757-0316		RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A1A2R29	0698-3438	8	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A1A2R30	0698-3438		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A1A2R31	0757-0316		RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A1A2R32	0757-0346	16	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A2R33	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A2R34	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A2R35	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A2R36	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A2R37	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A2R38	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A2R39	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A2R40	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A2R41	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1A2R42	0757-0403	7	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A1A2R43	0757-0403		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A1A2R44	0698-3442		RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A1A2U1	1820-0949	13	IC-DIGITAL CD4011AE CMOS QUAD 2 NAND	02735	CD4011AY
A1A2U2	1820-0949		IC-DIGITAL CD4011AE CMOS QUAD 2 NAND	02735	CD4011AY
A1A2U3	1820-1670	5	IC-DIGITAL DM75492N MOS HEX 1 DSPL DRVR	27014	DM75492N
A1A2U4	1820-1646	2	IC-DIGITAL CD4055BE CMOS 4 BCD-TO-7-SEG	02735	CD4055BY
A1A2U5	1820-1670		IC-DIGITAL DM75492N MOS HEX 1 DSPL DRVR	27014	DM75492N
A1A2U6	1858-0014	2	TRANSISTOR ARRAY DIP	28480	1858-0014
A1A2U7	1858-0014		TRANSISTOR ARRAY DIP	28480	1858-0014
A1A2U8	1820-1670		IC-DIGITAL DM75492N MOS HEX 1 DSPL DRVR	27014	DM75492N
A1A2U9	1820-1646		IC-DIGITAL CD4055BE CMOS 4 BCD-TO-7-SEG	02735	CD4055BY
A1A2U10	1820-1670		IC-DIGITAL DM75492N MOS HEX 1 DSPL DRVR	27014	DM75492N
A1A2U11	1820-1670		IC-DIGITAL DM75492N MOS HEX 1 DSPL DRVR	27014	DM75492N
A1A2U12	1821-0001	3	TRANSISTOR ARRAY DIP	02735	CA3046
A1A2U13	1820-1356	4	IC-DIGITAL MC14528CP CMOS DUAL	04713	MC14528CP
A1A2U14	1821-0001		TRANSISTOR ARRAY DIP	02735	CA3046
A1A2U15	1820-1317	3	IC-DIGITAL CD4047AE CMOS MONO/ASTBL	02735	CD4047AY
A1A2U16	1820-0939	8	IC-DIGITAL CD4013AE CMOS DUAL D-TYPE	02735	CD4013AY
A1A2U17	1820-1556	1	IC-DIGITAL CD4555BY CMOS DUAL 2 BIN	02735	CD4555BY
A1A2U18	1820-1146	1	IC-DIGITAL CD4050AE CMOS HEX 1 NON-INV	02735	CD4050AY
A1A2U19	1820-1693	7	IC-DIGITAL MC14508L CMOS DUAL D-TYPE	04713	MC14508
A1A2U20	1820-1436	2	IC SN74LS170N 16-BIT RAM TTL	01295	SN74LS170N
A1A2U21	1820-1436		IC SN74LS170N 16-BIT RAM TTL	01295	SN74LS170N
A1A2U22	1820-1693		IC-DIGITAL MC14508L CMOS DUAL D-TYPE	04713	MC14508
A1A2U23	1820-1437	2	IC-DIGITAL SN74LS221N TTL LS DUAL	01295	SN74LS221N
A1A2U24	1820-1437		IC-DIGITAL SN74LS221N TTL LS DUAL	01295	SN74LS221N
A2	04942-60002	1	THUMBWHEEL SWITCH PC BOARD ASSEMBLY	28480	04942-60002
A2J1	1200-0768	2	SOCKET-IC 14-CONT DIP-SLDR	91506	314-AG5D-3R
A2R1	1810-0255	1	RESISTIVE NETWORK	28480	1810-0255

Table 6-3. Replaceable Parts (3 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2S1	3100-3376	1	SWITCH, THUMBWHEEL	28480	3100-3376
A3	04942-60003	1	SWITCH PC BOARD ASSEMBLY	28480	04942-60003
A3CR1	1990-0442	2	LED-VISIBLE LUM-INT=300UCD IF=50MA-MAX	28480	1990-0442
A3CR2	1990-0442		LED-VISIBLE LUM-INT=300UCD IF=50MA-MAX	28480	1990-0442
A3J1	1251-3192	2	CONNECTOR 3-PIN M POST TYPE	27264	09-60-1031(2403-03A)
A3J2	1200-0768		SOCKET-IC 14-CONT DIP-SLDR	91506	314-AG5D-3R
A3J3	1251-3195	1	CONNECTOR 4-PIN M POST TYPE	27264	09-60-1041(2403-04A)
A3J4	1251-3192		CONNECTOR 3-PIN M POST TYPE	27264	09-60-1031(2403-03A)
A3J5	1251-3196	1	CONNECTOR 8-PIN M POST TYPE	27264	09-60-1081(2403-08A)
A3MP1			Not assigned		
A3MP2	4040-0706	2	BASE, LENS, LED, CLR PLASTIC	28480	4040-0706
A3MP3	4040-0706		BASE, LENS, LED, CLR PLASTIC	28480	4040-0706
A3P1	1251-3201	3	CONNECTOR 3-PIN F POST TYPE	27264	09-50-7031
A3P1	1251-3073		CONTACT-CONN FEM CRP	27264	08-50-0107
A3P3	1251-3297	1	CONNECTOR, 3-CONT, FEM, CIRCULAR K	71468	GK-E3-21C 5/8"
A3P3	1251-3073		CONTACT-CONN FEM CRP	27264	08-50-0107
A3P5	1251-3278	1	CONNECTOR 8-PIN F POST TYPE	27264	09-50-7081
A3P5	1251-3073		CONTACT-CONN FEM CRP	27264	08-50-0107
A3R1	0698-3438		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A3R2	0698-3438		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A3R3	0698-3438		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A3R4	0698-3438		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A3R5	0698-3438		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A3R6	0698-3438		RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A3S1	3101-2067	1	SWITCH-TGL SUBMIN DPDT NS 2A 250VAC	28480	3101-2067
A3S2	3101-2070	1	SWITCH-TGL SUBMIN SPDT NS 2A 250VAC	09353	7105-P3Y9CE-U15
A3S3	3101-2068	11	SWITCH-TGL SUBMIN SPDT NS 2A 250VAC	09353	7101-P3Y9CE-UII
A3S4	3101-2083	1	SWITCH-TGL SUBMIN SPDT NS 2A 250VAC	28480	3101-2083
A3S5	3101-2068		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC	09353	7101-P3Y9CE-UII
A3S6	3101-2068		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC	09353	7101-P3Y9CE-UII
A3S7	3101-2071	2	SWITCH-TGL SUBMIN SPDT NS 2A 250VAC	09353	7108-P3Y9CE-UI8
A3S8	3100-3375	1	SWITCH-RTRY SP7T-NS .5-DIA IDX-ANG=45	28480	3100-3375
A3S9	3101-2071		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC	09353	7108-P3Y9CE-UI8
A3S10	3101-2068		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC	09353	7101-P3Y9CE-UII
A3S11	5060-9436	2	SWITCH, PUSHBUTTON	28480	5060-9436
A3S12	5060-9436		SWITCH, PUSHBUTTON	28480	5060-9436
A3S13	3101-2068		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC	09353	7101-P3Y9CE-UII
A3S14	3101-2068		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC	09353	7101-P3Y9CE-UII
A3S15	3101-2068		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC	09353	7101-P3Y9CE-UII
A3S16	3101-2068		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC	09353	7101-P3Y9CE-UII
A3S17	3101-2068		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC	09353	7101-P3Y9CE-UII
A3S18	3101-2068		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC	09353	7101-P3Y9CE-UII
A3S19	3101-2068		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC	09353	7101-P3Y9CE-UII
A3W1	8120-1595	5 IN.	CABLE-UNSHLD 28AWG 50-CNDCT UL=2651 (P/O A3W1)	76381	3365-50
	0360-1706	1	CABLE TRANSITION 50-TERM INSUL DSPL TYPE (P/O A3W1) M	76381	3426-0000
	1251-2991	1	CONNECTOR-PC EDGE 25-CONT/ROW 2-ROWS F (P/O A3W1)(A5P1)	76381	3415-0001
A4	04942-60004	1	MONITOR AMPLIFIER PC BOARD ASSEMBLY	28480	04942-60004
A4C1	0150-0121	66	CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A4C2	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A4C3	0160-0157	1	CAPACITOR-FXD 4700PF +-10% 200WVDC POLYE	56289	292P47292
A4C4	0160-3451	110	CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A4C5	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A4J1	1250-1449	5	CONNECTOR-RF SM-SNP FEM PC 50-OHM	28480	1250-1449
A4L31	9160-0229	1	LOUDSPEAKER	28480	9160-0229
A4MP1	04942-00006	1	BRACKET, MONITOR AMPLIFIER	28480	04942-00006
A4MP2	0380-0754	2	STANDOFF-RVT-ON .125LG 4-40THD .250D BRS	71279	1300-9
A4MP3	0380-0754		STANDOFF-RVT-ON .125LG 4-40THD .250D BRS	71279	1300-9
A4MP4	04942-00009	1	SHIM, MONITOR BRACKET	28480	04942-00009
A4MP5	5040-7695	1	HOLDER, SPEAKER, BLK	28480	5040-7695
A4MP6	2200-0139	2	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	28480	2200-0139
A4MP7	2200-0139		SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	28480	2200-0139
A4MP8	2200-0153	2	SCREW-MACH 4-40 .875-IN-LG PAN-HD-POZI	28480	2200-0153
A4MP9	2200-0153		SCREW-MACH 4-40 .875-IN-LG PAN-HD-POZI	28480	2200-0153
A4MP10	2950-0001	1	NUT-HEX-DBL-CHAM 3/8-32-THD .094-THK	28480	2950-0030
A4Q1	1854-0039	4	TRANSISTOR NPN 2N3053 SI TO-5 PD=1W	04713	2N3053
A4Q2	1854-0039		TRANSISTOR NPN 2N3053 SI TO-5 PD=1W	04713	2N3053

Table 6-3. Replaceable Parts (4 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4R1	2100-3536	1	RESISTOR-VAR CONTROL CP 50K 20% CWLOG	32997	3851A-286-503D
A4R2	0683-1055	14	RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A4R3	0757-0438	27	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A4R4	0757-0199	24	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A4R5	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A4R6	0757-0442	127	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R7	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A4R8	0757-0461		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A4R9	0757-0403		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A4R10	0757-0279	7	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A4R11	0757-0419	8	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A4R12	0757-0403		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A4R13	0757-0403		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A4T1	9100-0382	1	TRANSFORMER	28480	9100-0382
A4U1	1826-0328	36	IC RV 4558 OP AMP	07933	RV4558DN
A4A3P4	1251-3073		CONTACT-CONN FEM CRP	27264	08-50-0107
A4A3P4	1251-3201		CONNECTOR 3-PIN F POST TYPE	27264	09-50-7031
A5	04942-60005	1	MOTHER PC BOARD ASSEMBLY	28480	04942-60005
A5J2	1250-1449		CONNECTOR-RF SM-SNP FEM PC 50-OHM	28480	1250-1449
A5J3	1251-4245	1	CONNECTOR 2-PIN M POST TYPE	27264	09-65-1021
A5J4	1251-4246	1	CONNECTOR 3-PIN M POST TYPE	27264	09-65-1031
A5MP1	04942-00019	2	PLATE, TRANSFORMER NUT	28480	04942-00019
A5MP2	04942-00019		PLATE, TRANSFORMER NUT	28480	04942-00019
A5MP3	2200-0155	2	SCREW-MACH 4-40 1-IN-LG PAN-HD-POZI	28480	2200-0155
A5MP4	2200-0155		SCREW-MACH 4-40 1-IN-LG PAN-HD-POZI	28480	2200-0155
A5P3	1251-3613	1	CONNECTOR 2-PIN F POST TYPE	27264	09-50-7021
A5P3	1251-3073		CONTACT-CONN FEM CRP	27264	08-50-0107
A5P4	1251-3201		CONNECTOR 3-PIN F POST TYPE	27264	09-50-7031
A5P4	1251-3073		CONTACT-CONN FEM CRP	27264	08-50-0107
A5T1	9100-1309	1	TRANSFORMER, AUDIO	28480	9100-1309
A5XA6	1251-1887	13	CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	71785	252-22-30-340
A5XA8	1251-1887		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	71785	252-22-30-340
A5XA9	1251-1887		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	71785	252-22-30-340
A5XA10	1251-1887		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	71785	252-22-30-340
A5XA11	1251-1887		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	71785	252-22-30-340
A5XA13	1251-1887		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	71785	252-22-30-340
A5XA14	1251-1887		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	71785	252-22-30-340
A5XA15	1251-4276	1	CONNECTOR-PC EDGE 43-CONT/ROW 2-ROWS	28480	1251-4276
A5XA16	1251-1887		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	71785	252-22-30-340
A5XA17	1251-1887		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	71785	252-22-30-340
A5XA18	1251-1887		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	71785	252-22-30-340
A5XA19	1251-1887		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	71785	252-22-30-340
A5XA20	1251-1887		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	71785	252-22-30-340
A5XA21	1251-1887		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	71785	252-22-30-340
			MISCELLANEOUS		
	04942-00029	1	BRACKET, PC BOARD, 2-SLOTS (NOT PART OF 04942-60005)	28480	04942-00029
	2360-0195	3	SCREW, MACHINE 6-32 X 5/16"	28480	2360-0195
	2420-0015	5	NUT, W/EXT LOCK, 6-32 THREAD	28480	2420-0015
	2190-0007	1	WASHER, INT, LOCK, #6	78189	1906-00
A5A23P1	1251-4270	1	CONNECTOR 10-PIN F UTILITY	28480	1251-4270
A5A23P1	1251-4272	10	CONTACT-CONN U/W-UTIL FEM CRP	28480	1251-4272
A6	04942-60006	1	INPUT PC BOARD ASSEMBLY	28480	04942-60006
A6C1	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A6C2	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6C3	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A6C4	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6C5	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A6C6	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6C7	0180-0397	1	CAPACITOR-FXD 40UF+50-10% 200VDC AL NPOL	28480	0180-0397
A6C8	0180-0361	2	CAPACITOR-FXD 10UF+50-10% 350VDC AL	56289	34D106F350FJ4
A6C9	0180-0361		CAPACITOR-FXD 10UF+50-10% 350VDC AL	56289	34D106F350FJ4
A6C10	0140-0192	1	CAPACITOR-FXD 68PF +-5% 300WVDC MICA	72136	DM15E680J0300WV1CR
A6C11	0160-2199	1	CAPACITOR-FXD 30PF +-5% 300WVDC MICA	28480	0160-2199
A6C12	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6C13	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6C14	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A6C15	0160-0840	1	CAPACITOR-FXD 834PF +-1% 100WVDC MICA	28480	0160-0840

Table 6-3. Replaceable Parts (5 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6C16	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A6CR1	1901-0040	46	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR5	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR6	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR7	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6J1	1251-3638	2	CONNECTOR 6-PIN M POST TYPE	28480	1251-3638
A6J2	1250-1449		CONNECTOR-RF SM-SNP FEM PC 50-OHM	28480	1250-1449
A6J3	1250-1449		CONNECTOR-RF SM-SNP FEM PC 50-OHM	28480	1250-1449
A6JU1	8120-0202	6 IN.	CABLE-SHLD 2-COND 22-AWG	16428	8451
A6K1	0490-0647	1	RELAY-REED 2A 500MA 200VDC 24VDC-COIL	28480	0490-0647
A6K2	0490-0648	5	RELAY-REED 2C 250MA 28VDC 24VDC-COIL 3VA	28480	0490-0648
A6K3	0490-0648		RELAY-REED 2C 250MA 28VDC 24VDC-COIL 3VA	28480	0490-0648
A6K4	0490-0646	2	RELAY-REED 1A 500MA 200VDC 24VDC-COIL	28480	0490-0646
A6K5	0490-0646		RELAY-REED 1A 500MA 200VDC 24VDC-COIL	28480	0490-0646
A6L1	9100-3916	1	COIL/INDUCTOR 300 MH	28480	9100-3916
A6MP1	0403-0234	2	EXTR-PC BD BLK NYL .062-BD-THKNS	06915	CRE-11
A6MP2	1400-0482	7	CABLE TIE .062-3-DIA .14-WD NYL	59730	TY26M-8
A6P1	1251-2993	1	CONNECTOR 6-PIN F POST TYPE	27264	09-50-3061
A6P1	1251-3073		CONTACT-CONN FEM CRP	27264	08-50-0107
A6Q1	1854-0071	35	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q2	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q3	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q4	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q5	1853-0336	8	TRANSISTOR PNP SI PD=625MW FT=100MHZ	28480	1853-0336
A6Q6	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q7	1853-0336		TRANSISTOR PNP SI PD=625MW FT=100MHZ	28480	1853-0336
A6Q8	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q9	1853-0336		TRANSISTOR PNP SI PD=625MW FT=100MHZ	28480	1853-0336
A6Q10	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q11	1853-0336		TRANSISTOR PNP SI PD=625MW FT=100MHZ	28480	1853-0336
A6Q12	1853-0036	11	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A6Q13	1855-0078	2	TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0078
A6R1	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R2	0757-0447	10	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A6R3	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R4	0698-3153	7	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A6R5	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R6	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A6R7	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R8	0757-0447		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A6R9	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R10	0698-3150	3	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A6R11	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R12	0698-3445	1	RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A6R13	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R14	0757-0447		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A6R15	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R16	0698-3153		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A6R17	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R18	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A6R19	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R20	0757-0447		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A6R21	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R22	0698-3153		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A6R23	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R24	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A6R25	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R26	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R27	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R28	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A6R29	0698-6458	1	RESISTOR 306.5 .1% .125W F TC=0+-50	24546	NC55
A6R30	0698-6457	1	RESISTOR 605.2 .1% .125W F TC=0+-50	24546	NC55
A6R31	0698-3441	8	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A6R32	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A6R33	0698-6911	1	RESISTOR 51.1K .5% .125W F TC=0+-50	24546	NC55
A6R34	0698-8015	1	RESISTOR 23.7K .5% .125W F TC=0+-50	19701	MF4C1/8-T2-2372-D
A6R35	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F

Table 6-3. Replaceable Parts (6 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6R36	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R37	0757-0280	21	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R38	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R39	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R40	0757-0278	2	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A6R41	0698-3159	3	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A6R42	0757-0416	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A6R43	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6T1	9100-3825	1	TRANSFORMER, AUDIO	28480	9100-3825
A7			NOT ASSIGNED		
A8	04942-60008	1	MODEM PC BOARD ASSEMBLY	28480	04942-60008
A8C1	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A8C2	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A8C3	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A8C4	0160-0939	2	CAPACITOR-FXD 430PF +-5% 300WVDC MICA	28480	0160-0939
A8C5	0180-0291	4	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A8C6	0160-4357		CAPACITOR-FXD .01UF	28480	0160-4357
A8C7	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C8	0160-4357		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-4357
A8C9	0160-4357		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-4357
A8C10	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C11	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C12	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A8C13	0160-3902	9	CAPACITOR-FXD .1UF +-10% 200WVDC POLYC	84411	MEW-273
A8C14	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C15	0160-3902		CAPACITOR-FXD .1UF +-10% 200WVDC POLYC	84411	MEW-273
A8C16	0160-3902		CAPACITOR-FXD .1UF +-10% 200WVDC POLYC	84411	MEW-273
A8C17	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C18	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C19	0170-0066	1	CAPACITOR-FXD .027UF +-10% 200WVDC POLYE	56289	292P27392
A8C20	0160-3902		CAPACITOR-FXD .1UF +-10% 200WVDC POLYC	84411	MEW-273
A8C21	0180-2206	2	CAPACITOR-FXD 60UF+-10% 6VDC TA	56289	150D606X9006B2
A8C22	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C23	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C24	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A8C25	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C26	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C27	0160-3548	10	CAPACITOR-FXD .01UF +-1% 100WVDC MICA	28480	0160-3548
A8C28	0160-3548		CAPACITOR-FXD .01UF +-1% 100WVDC MICA	28480	0160-3548
A8C29	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C30	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C31	0160-3548		CAPACITOR-FXD .01UF +-1% 100WVDC MICA	28480	0160-3548
A8C32	0160-3548		CAPACITOR-FXD .01UF +-1% 100WVDC MICA	28480	0160-3548
A8C33	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C34	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C35	0160-2732	6	CAPACITOR-FXD 1250PF +-1% 500WVDC MICA	28480	0160-2732
A8C36	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C37	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C38	0160-2732		CAPACITOR-FXD 1250PF +-1% 500WVDC MICA	28480	0160-2732
A8C39	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C40	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C41	0160-2721	6	CAPACITOR-FXD 5100PF +-5% 500WVDC MICA	28480	0160-2721
A8C42	0160-2721		CAPACITOR-FXD 5100PF +-5% 500WVDC MICA	28480	0160-2721
A8C43	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C44	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C45	0160-2721		CAPACITOR-FXD 5100PF +-5% 500WVDC MICA	28480	0160-2721
A8C46	0160-2721		CAPACITOR-FXD 5100PF +-5% 500WVDC MICA	28480	0160-2721
A8C47	0160-2721		CAPACITOR-FXD 5100PF +-5% 500WVDC MICA	28480	0160-2721
A8C48	0160-2721		CAPACITOR-FXD 5100PF +-5% 500WVDC MICA	28480	0160-2721
A8C49	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C50	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C51	0180-0228	8	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X901582
A8C52	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C53	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C54	0160-2732		CAPACITOR-FXD 1250PF +-1% 500WVDC MICA	28480	0160-2732
A8C55	0160-2732		CAPACITOR-FXD 1250PF +-1% 500WVDC MICA	28480	0160-2732
A8C56	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C57	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C58	0160-2732		CAPACITOR-FXD 1250PF +-1% 500WVDC MICA	28480	0160-2732
A8C59	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C60	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C61	0160-2732		CAPACITOR-FXD 1250PF +-1% 500WVDC MICA	28480	0160-2732

Table 6-3. Replaceable Parts (7 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8C62	0180-0228		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X901582
A8C63	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C64	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C65	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8C66	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A8CR1	1902-3149	2	DIODE-ZNR 9.09V 5% DO-7 PD=.4W TC=+.057%	04713	SZ 10939-170
A8CR2	1902-3149		DIODE-ZNR 9.09V 5% DO-7 PD=.4W TC=+.057%	04713	SZ 10939-170
A8CR3	1902-0041	1	DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	15818	CD 35622
A8CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR5	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR6	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR7	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR9	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR10	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR11	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR12	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8J1	1251-3638		CONNECTOR 6-PIN M POST TYPE	28480	1251-3638
A8MP1	0403-0238	2	EXTR-PC BD RED NYL .062-BD-THKNS	06915	CBE-13
A8Q1	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A8Q2	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q3	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q4	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8R1	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R2	0757-0461		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A8R3	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A8R4	0757-0458	10	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A8R5	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R6	0757-0463	3	RESISTOR 82.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8252-F
A8R7	2100-3103	2	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-103
A8R8	0757-0459	2	RESISTOR 56.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5622-F
A8R9	2100-3056	4	RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-502
A8R10	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A8R11	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R12	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A8R13	0757-0444	8	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A8R14	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R15	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R16	0698-3429	2	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A8R17	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R18	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A8R19	0698-3157	24	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A8R20	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R21	0698-3429		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A8R22	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R23	0757-0290	6	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A8R24	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A8R25	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A8R26	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A8R27	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A8R28	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A8R29	0698-3158	3	RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A8R30	0757-0200	2	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A8R31	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R32	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A8R33	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A8R34	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R35	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A8R36	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R37	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R38	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R39	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R40	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A8R41	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R42	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R43	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R44	0698-3450	11	RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A8R45	0757-0422	2	RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A8R46	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R47	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A8R48	0698-3453	3	RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F
A8R49	0811-0691	8	RESISTOR 7.998K .1% .062W PWW TC=0+-15	20940	135
A8R50	0811-0691		RESISTOR 7.998K .1% .062W PWW TC=0+-15	20940	135

Table 6-3. Replaceable Parts (8 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8R51	0811-0691		RESISTOR 7.998K .1% .062W PWW TC=0+-15	20940	135
A8R52	0811-0691		RESISTOR 7.998K .1% .062W PWW TC=0+-15	20940	135
A8R53	0698-3453		RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F
A8R54	0811-0691		RESISTOR 7.998K .1% .062W PWW TC=0+-15	20940	135
A8R55	0811-0691		RESISTOR 7.998K .1% .062W PWW TC=0+-15	20940	135
A8R56	0811-0691		RESISTOR 7.998K .1% .062W PWW TC=0+-15	20940	135
A8R57	0811-0691		RESISTOR 7.998K .1% .062W PWW TC=0+-15	20940	135
A8R58	0698-3457	6	RESISTOR 316K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A8R59	0698-3457		RESISTOR 316K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A8R60	0811-0686	12	RESISTOR 63.662K .25% .062W PWW TC=0+-20	20940	135
A8R61	0811-0686		RESISTOR 63.662K .25% .062W PWW TC=0+-20	20940	135
A8R62	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R63	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R64	0757-0460	13	RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A8R65	0757-0288	8	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A8R66	0757-0467	4	RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A8R67	0757-0460		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A8R68	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A8R69	0757-0467		RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A8R70	0757-0460		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A8R71	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A8R72	0757-0467		RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A8R73	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R74	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A8R75	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R76	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R77	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R78	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R79	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A8R80	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R81	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R82	0757-0289	6	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A8R83	0698-0084	12	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A8R84	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R85	0698-3457		RESISTOR 316K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A8R86	0698-3457		RESISTOR 316K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A8R87	0811-0686		RESISTOR 63.662K .25% .062W PWW TC=0+-20	20940	135
A8R88	0811-0686		RESISTOR 63.662K .25% .062W PWW TC=0+-20	20940	135
A8R89	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R90	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R91	0698-3457		RESISTOR 316K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A8R92	0698-3457		RESISTOR 316K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A8R93	0811-0686		RESISTOR 63.662K .25% .062W PWW TC=0+-20	20940	135
A8R94	0811-0686		RESISTOR 63.662K .25% .062W PWW TC=0+-20	20940	135
A8R95	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R96	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R97	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R98	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A8R99	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R100	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R101	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R102	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R103	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R104	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A8R105	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8R106	0698-3156	10	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A8R107	0698-3444	1	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-T0-316R-F
A8R108	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R109	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R110	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A8U1	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A8U2	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A8U3	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A8U4	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A8U5	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A8U6	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A8U7	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A8U8	1820-0493	19	IC LM 307 OP AMP	27014	LM307N
A8U9	1826-0154	8	IC-DIGITAL DG200BA CMOS 2-CHAN ANAL	17856	DG200BA
A8U10	1826-0180	3	IC NE 555 TIMER	18324	NE555V
A8U11	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A8U12	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A8U13	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A8U14	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A8U15	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,

Table 6-3. Replaceable Parts (9 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8U16	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A8U17	1826-0321	5	IC CA 3099 COMPARATOR	02735	CA3099E
A8U18	1826-0180		IC NE 555 TIMER	18324	NE555V
A8U19	1826-0321		IC CA 3099 COMPARATOR	02735	CA3099E
A8U20	1820-1188	1	IC CD 4046A PL LOOP	02735	CD4046AY
A8U21	1820-0931	3	IC-DIGITAL CD4029AE CMOS BIN UP/DOWN	02735	CD4029AY
A8U22	1820-0931		IC-DIGITAL CD4029AE CMOS BIN UP/DOWN	02735	CD4029AY
A8U23	1820-0931		IC-DIGITAL CD4029AE CMOS BIN UP/DOWN	02735	CD4029AY
A8U24	1820-1690	1	IC, MC6850	04713	MC6850
A8U25	1820-0939		IC-DIGITAL CD4013AE CMOS DUAL D-TYPE	02735	CD4013AY
A8U26	1820-0949		IC-DIGITAL CD4011AE CMOS QUAD 2 NAND	02735	CD4011AY
A8U27	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A8VR1	1990-0449	4	OPTO-ISOLATOR LAMP-PCNDCT IF=50MA-MAX	03911	CLM8000
A9	04942-60009	1	FILTER MODULATOR PC BOARD ASSEMBLY	28480	04942-60009
A9C1	0150-0050	2	CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A9C2	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A9C3	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A9C4	0160-2251	1	CAPACITOR-FXD 5.6PF +-.25PF 500WVDC CER	28480	0160-2251
A9C5	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A9C6	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A9C7	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A9C8	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A9C9	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A9C10	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A9C11	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A9C12	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A9C13	0160-2227	2	CAPACITOR-FXD 2400PF +-5% 300WVDC MICA	28480	0160-2227
A9C14	0160-2227		CAPACITOR-FXD 2400PF +-5% 300WVDC MICA	28480	0160-2227
A9C15	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A9C16	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A9C17	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A9C18	0160-0161		CAPACITOR-FXD .01UF +-10% 200WVDC POLYE	56289	292P10392
A9CR1	1901-0376	24	DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR2	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR3	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR4	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR5	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR6	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR7	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR8	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR9	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR10	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9CR11	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A9MP1	0403-0236	2	EXTR-PC BD ORN NYL .062-BD-THKNS	06915	C8E-14
A9Q1	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A9R1	1810-0223		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	56289	216CH-126-CRR
A9R2	0757-0464	2	RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A9R3	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A9R4	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A9R5	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A9R6	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A9R7	1810-0226	1	NETWORK-RES 16-PIN-DIP .1-PIN-SPCG	28480	1810-0226
A9R8	0757-0123	2	RESISTOR 34.8K 1% .125W F TC=0+-100	24546	C4, T=0
A9R9	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-502
A9R10	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A9R11	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A9R12	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A9R13	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A9R14	0698-4002	4	RESISTOR 5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5001-F
A9R15	0698-4002		RESISTOR 5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5001-F
A9R16	0698-3154	3	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A9R17	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A9R18	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A9R19	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A9R20	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A9R21	0757-0461		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A9R22	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A9R23	0757-0461		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A9R24	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A9R25	0698-4002		RESISTOR 5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5001-F

Table 6-3. Replaceable Parts (10 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9R26	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A9R27	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A9R28	0757-0274	2	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A9R29	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A9R30	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A9R31	0698-3162	3	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A9R32	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A9R33	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A9R34	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A9R35	0757-0401	23	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A9R36	2100-3161	3	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-203
A9R37	2100-3161		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-203
A9R38	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A9R39	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A9R40	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A9R41	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A9TP1	0360-0124	71	TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A9U1	1826-0295	1	IC AD 533J MULTIPLIER	24355	AD533JH
A9U2	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A9U3	1826-0309	2	IC AD 518J OP AMP	24355	AD518J
A9U4	1820-0976	3	IC-DIGITAL CD4015AE CMOS DUAL D-TYPE	02735	CD4015AY
A9U5	1820-0976		IC-DIGITAL CD4015AE CMOS DUAL D-TYPE	02735	CD4015AY
A9U6	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A9U7	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A9U8	1820-0936	1	IC-DIGITAL CD4024AE CMOS BIN SYNCHRO	02735	CD4024AY
A9U9	1820-0949		IC-DIGITAL CD4011AE CMOS QUAD 2 NAND	02735	CD4011AY
A9U10	1826-0154		IC-DIGITAL DG200BA CMOS 2-CHAN ANAL	17856	DG200BA
A9U11	1820-0949		IC-DIGITAL CD4011AE CMOS QUAD 2 NAND	02735	CD4011AY
A9U12	1826-0154		IC-DIGITAL DG200BA CMOS 2-CHAN ANAL	17856	DG200BA
A9U13	1826-0154		IC-DIGITAL DG200BA CMOS 2-CHAN ANAL	17856	DG200BA
A9VR1	1990-0449		OPTO-ISOLATOR LAMP-PCNDCT IF=50MA-MAX	03911	CLM8000
A10	04942-60010	1	TRANSMIT CONTROL PC BOARD ASSEMBLY	28480	04942-60010
A10C1	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A10C2	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A10C3	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A10C4	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A10C5	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A10C6	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A10C7	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A10C8	0160-0168	2	CAPACITOR-FXD .1UF +-10% 200WVDC POLYE	56289	292P10492
A10C9	0160-0168		CAPACITOR-FXD .1UF +-10% 200WVDC POLYE	56289	292P10492
A10J1	1200-0767	4	SOCKET-IC 16-CONT DIP-SLDR-TERMS	91506	316-AG5D-3R
A10MP1	0403-0239	2	EXTR-PC BD YEL NYL .062-BD-THKNS	06915	CBE-15
A10R1	1810-0223		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	56289	216CM-126-CRR
A10R2	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A10R3	1810-0223		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	56289	216CM-126-CRR
A10R4	1810-0225	1	NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	28480	1810-0225
A10R5	0698-4491	1	RESISTOR 30.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3092-F
A10R6	0698-3155	4	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A10R7	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A10R8	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A10R9	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A10U1	1820-0939		IC-DIGITAL CD4013AE CMOS DUAL D-TYPE	02735	CD4013AY
A10U2	1820-1328	6	IC-DIGITAL MC14526CP CMOS BIN	04713	MC14526CP
A10U3	1820-0938	4	IC-DIGITAL CD4027AE CMOS DUAL J-K	02735	CD4027AY
A10U4	1820-1328		IC-DIGITAL MC14526CP CMOS BIN	04713	MC14526CP
A10U5	1820-0939		IC-DIGITAL CD4013AE CMOS DUAL D-TYPE	02735	CD4013AY
A10U6	1820-1328		IC-DIGITAL MC14526CP CMOS BIN	04713	MC14526CP
A10U7	1820-0938		IC-DIGITAL CD4027AE CMOS DUAL J-K	02735	CD4027AY
A10U8	1820-1328		IC-DIGITAL MC14526CP CMOS BIN	04713	MC14526CP
A10U9	1820-0939		IC-DIGITAL CD4013AE CMOS DUAL D-TYPE	02735	CD4013AY
A10U10	1820-0949		IC-DIGITAL CD4011AE CMOS QUAD 2 NAND	02735	CD4011AY
A10U11	1820-0976		IC-DIGITAL CD4015AE CMOS DUAL D-TYPE	02735	CD4015AY
A10U12	1820-1693		IC-DIGITAL MC14508L CMOS DUAL D-TYPE	04713	MC14508
A10U13	1820-0949		IC-DIGITAL CD4011AE CMOS QUAD 2 NAND	02735	CD4011AY
A10U14	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A11	04942-60011	1	OUTPUT PC BOARD ASSEMBLY	28480	04942-60011

Table 6-3. Replaceable Parts (11 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11C1	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A11C2	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A11C3	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A11C4	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A11C5	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A11C6	0160-2263	1	CAPACITOR-FXD 18PF +-5% 500WVDC CER	28480	0160-2263
A11C7	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A11C8	0160-2244	1	CAPACITOR-FXD 3PF +-.25PF 500WVDC CER	28480	0160-2244
A11C9	0180-2207	3	CAPACITOR-FXD 100UF+-10% 10VDC TA	56289	150D107X9010R2
A11C10	0180-2207		CAPACITOR-FXD 100UF+-10% 10VDC TA	56289	150D107X9010R2
A11C11	0180-2207		CAPACITOR-FXD 100UF+-10% 10VDC TA	56289	150D107X9010R2
A11C12	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A11C13	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A11C14	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A11C15	0180-2634	1	CAPACITOR-FXD 85UF+50-10% 200VDC AL NPOL	28480	0180-2634
A11CR1	1910-0016	2	DIODE-GE 60V 60NA 1US DO-7	28480	1910-0016
A11CR2	1910-0016		DIODE-GE 60V 60NA 1US DO-7	28480	1910-0016
A11CR3	1902-0025	3	DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	28480	1902-0025
A11CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR5	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR6	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR7	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR9	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR10	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR11	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11K1	0490-0648		RELAY-REED 2C 250MA 28VDC 24VDC-COIL 3VA	28480	0490-0648
A11K2	0490-0648		RELAY-REED 2C 250MA 28VDC 24VDC-COIL 3VA	28480	0490-0648
A11K3	0490-0648		RELAY-REED 2C 250MA 28VDC 24VDC-COIL 3VA	28480	0490-0648
A11MP1	0403-0237	1	EXTR-PC BD GRN NYL .062-BD-THKNS	06915	CBE-9
A11MP2	1400-0482		CABLE TIE .062-3-DIA .14-WD NYL	59730	TY26M-8
A11MP3	1400-0482		CABLE TIE .062-3-DIA .14-WD NYL	59730	TY26M-8
A11MP4	1200-0173	2	INSULATOR-XSTR TO-5 .075-THK	28480	1200-0173
A11MP5	1200-0173		INSULATOR-XSTR TO-5 .075-THK	28480	1200-0173
A11Q1	1854-0039		TRANSISTOR NPN 2N3053 SI TO-5 PD=1W	04713	2N3053
A11Q2	1854-0039		TRANSISTOR NPN 2N3053 SI TO-5 PD=1W	04713	2N3053
A11Q3	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A11Q4	1853-0336		TRANSISTOR PNP SI PD=625MW FT=100MHZ	28480	1353-0336
A11Q5	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A11Q6	1853-0336		TRANSISTOR PNP SI PD=625MW FT=100MHZ	28480	1853-0336
A11Q7	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A11Q8	1853-0336		TRANSISTOR PNP SI PD=625MW FT=100MHZ	28480	1853-0036
A11Q9	1853-0336		TRANSISTOR PNP SI PD=625MW FT=100MHZ	28480	1853-0336
A11Q10	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A11R1	1810-0223		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	56289	216CM-126-CRR
A11R2	0698-3449	3	RESISTOR 28.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2872-F
A11R3	0698-3449		RESISTOR 28.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2872-F
A11R4	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R5	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R6	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A11R7	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A11R8	0698-3452	3	RESISTOR 147K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1473-F
A11R9	0698-3449		RESISTOR 28.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2872-F
A11R10	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R11	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R12	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A11R13	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A11R14	0698-8711	1	RESISTOR 6.601K .1% .125W F TC=0+-25	19701	MF4C-1
A11R15	0698-6348	1	RESISTOR 3K .1% .125W F TC=0+-25	24546	NE55
A11R16	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A11R17	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R18	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R19	0757-0420	6	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A11R20	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A11R21	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A11R22	0757-0159	1	RESISTOR 1K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-1R0-F
A11R23	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A11R24	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A11R25	0757-0460		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A11R26	0698-3437	3	RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A11R27	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R28	0757-0123		RESISTOR 34.8K 1% .125W F TC=0+-100	24546	C4, T=0
A11R29	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A11R30	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F

Table 6-3. Replaceable Parts (12 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11R31	0698-7408	1	RESISTOR 600 .1% .125W F TC=0+-50	19701	MF4C1/8-T2-600R-B
A11R32	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A11R33	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A11R34	0698-3437		RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A11R35	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A11R36	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R37	0698-3437		RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-T0-133R-F
A11R38	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R39	2100-3109	12	RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-202
A11R40	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R41	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A11R42	0757-0447		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A11R43	0757-0447		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A11R44	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R45	0698-3153		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A11R46	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A11R47	0757-0447		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A11R48	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A11R49	0757-0447		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A11R50	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11P51	0698-3153		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A11R52	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A11R53	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A11R54	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A11R55	0757-0447		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A11R56	0757-0447		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A11R57	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A11R58	0698-3153		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A11R59	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A11U1	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A11U2	1820-1144	2	IC-DIGITAL SN74LS02N TTL LS QUAD 2 NOR	01295	SN74LS02N
A11U3	1820-1315	5	IC-DIGITAL CD4051BE CMOS	02735	CD4051BY
A11U4	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A11U5	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A11U6	1820-1315		IC-DIGITAL CD4051BE CMOS	02735	CD4051BY
A11VR1	1990-0449		OPTO-ISOLATOR LAMP-PCNDCT IF=50MA-MAX	03911	CLM8000
A12			NOT ASSIGNED		
A13	04942-60013	1	TRANSMITTER & LATCH PC BOARD ASSEMBLY	28480	04942-60013
A13C1	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A13C2	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A13C3	0160-2204	9	CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A13C4	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A13C5	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A13C6	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A13C7	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A13C8	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A13C9	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A13C10	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A13C11	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A13C12	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A13C13	0160-2218	2	CAPACITOR-FXD 1000PF +-5% 300WVDC MICA	28480	0160-2218
A13C14	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A13C15	0160-3071	2	CAPACITOR-FXD 10UF +-10% 100WVDC MET	00853	17U8106K
A13C16	0160-0127	6	CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A13C17	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A13C18	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A13C19	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A13C20	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A13C21	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A13C22	0160-2218		CAPACITOR-FXD 1000PF +-5% 300WVDC MICA	28480	0160-2218
A13C23	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A13C24	0180-0159	1	CAPACITOR-FXD 220UF+-20% 10VDC TA	56289	150D227X0010B2
A13C25	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A13C26	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A13CR1	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A13CR2	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A13CR3	1901-0049	2	DIODE-PWR RECT 50V 750MA DO-29	28480	1901-0049
A13CR4	1901-0049		DIODE-PWR RECT 50V 750MA DO-29	28480	1901-0049
A13J1	1200-0564	2	SOCKET-IC 8-CONT DIP-SLDR-TERMS	28480	1200-0564
A13J2	1200-0767		SOCKET-IC 16-CONT DIP-SLDR-TERMS	91506	316-AG5D-3R
A13J3	1200-0767		SOCKET-IC 16-CONT DIP-SLDR-TERMS	91506	316-AG5D-3R

Table 6-3. Replaceable Parts (13 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A13MP1	0403-0241	2	EXTR-PC BD VIO NYL .062-BD-THKNS	06915	CBE-17
A13MP2	0403-0241		EXTR-PC BD VIO NYL .062-BD-THKNS	06915	CBE-17
A13MP3	1400-0482		CABLE TIE .062-3-DIA .14-WD NYL	59730	TY26M-8
A13Q1	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A13Q2	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A13Q3	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A13Q4	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A13R1	1810-0223		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	56289	216CH-126-CRR
A13R2	1810-0223		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	56289	216CH-126-CRR
A13R3	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A13R4	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A13R5	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A13R6	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A13R7	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A13R8	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A13R9	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A13R10	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A13R11	1810-0055	3	NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0055
A13R12	0698-3160	1	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A13R13	0757-0467		RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A13R14	0757-0460		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A13R15	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A13R16	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A13R17	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A13R18	0698-6360	9	RESISTOR 10K .1% .125W F TC=0+-25	24546	NE55
A13R19	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A13R20	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A13R21	0698-6630	1	RESISTOR 20K .1% .125W F TC=0+-25	24546	NE55
A13R22	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A13R23	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A13R24	0698-6627	1	RESISTOR 25K .1% .125W F TC=0+-25	24546	NE55
A13R25	0698-4009	1	RESISTOR 50K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5002-F
A13R26	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A13R27	0757-0472	1	RESISTOR 200K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2003-F
A13R28	0698-4011	1	RESISTOR 250K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2503-F
A13R29	0683-5145	1	RESISTOR 510K 5% .25W FC TC=-800/+900	01121	CB5145
A13R30	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A13R31	0683-2055	4	RESISTOR 2M 5% .25W FC TC=-900/+1100	01121	CB2055
A13R32	0683-2455	1	RESISTOR 2.4M 5% .25W FC TC=-900/+1100	01121	CB2455
A13R33	0683-4755	1	RESISTOR 4.7M 5% .25W FC TC=-900/+1100	01121	CB4755
A13R34	0683-1065	1	RESISTOR 10M 5% .25W FC TC=-900/+1100	01121	CB1065
A13R35	0683-2265	1	RESISTOR 22M 5% .25W FC TC=-900/+1200	01121	CB2265
A13R36	0698-3159		RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A13R37	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A13R38	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A13R39	0698-3159		RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A13R40	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A13R41	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A13R42	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A13R43	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A13R44	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A13R45	0698-3136	1	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1782-F
A13R46	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A13R47	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A13R48	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A13R49	2100-3109		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-202
A13R50	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A13R51	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A13R52	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A13R53	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A13R54	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A13R55	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A13R56	1810-0223		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	56289	216CH-126-CRR
A13TP1	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A13TP2	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A13TP3	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A13TPENAB	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A13TPF64	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A13TPROM	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A13U1	1820-0493		IC LM 307 OP AMP	27014	LM307N
A13U2	1820-1648	1	IC-DIGITAL XR-2207CP	0016E	XR-2207CP
A13U3	1826-0182	2	IC AD 540J OP AMP	24355	A540J
A13U4	1820-1325	1	IC-DIGITAL CD4066AE CMOS QUAD BILATL	02735	CD4066AY
A13U5	1820-0944	2	IC-DIGITAL CD4025AE CMOS TPL 3 NOR	02735	CD4025AY

Table 6-3. Replaceable Parts (14 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A13U6	1820-0943	2	IC-DIGITAL CD4023AE CMOS TPL 3 NAND	02735	CD4023AY
A13U7	1820-0949		IC-DIGITAL CD4011AE CMOS QUAD 2 NAND	02735	CD4011AY
A13U8	1820-0949		IC-DIGITAL CD4011AE CMOS QUAD 2 NAND	02735	CD4011AY
A13U9	1818-2268	1	IC, ROM, 512 X 8	28480	1818-2268
A13U10	1820-1649	1	IC-DIGITAL CD4059AD CMOS DIV X N	02735	CD4059AD
A13U11	1820-0949		IC-DIGITAL CD4011AE CMOS QUAD 2 NAND	02735	CD4011AY
A13U12	1820-0946	2	IC-DIGITAL CD4001AE CMOS QUAD 2 NOR	02735	CD4001AY
A13U13	1820-0939		IC-DIGITAL CD4013AE CMOS DUAL D-TYPE	02735	CD4013AY
A13U14	1820-1114	1	IC-DIGITAL MC14516CP CMOS BIN	04713	MC14516CP
A13U15	1820-1189	3	IC-DIGITAL MC14510CP CMOS BCD	04713	MC14510CP
A13U16	1820-1387	1	IC-DIGITAL MC14519CP CMOS AND-OR	04713	MC14519CP
A13U17	1820-0939		IC-DIGITAL CD4013AE CMOS DUAL D-TYPE	02735	CD4013AY
A13U18	1820-0939		IC-DIGITAL CD4013AE CMOS DUAL D-TYPE	02735	CD4013AY
A13U19	1820-1189		IC-DIGITAL MC14510CP CMOS BCD	04713	MC14510CP
A13U20	1820-1189		IC-DIGITAL MC14510CP CMOS BCD	04713	MC14510CP
A13U21	1820-0757	6	IC-DIGITAL TTL L	28480	1820-0757
A13U22	1820-0757		IC-DIGITAL TTL L	28480	1820-0757
A13U23	1820-0943		IC-DIGITAL CD4023AE CMOS TPL 3 NAND	02735	CD4023AY
A13U24	1820-1199	7	IC-DIGITAL SN74LS04N TTL LS HEX 1	01295	SN74LS04N
A13U25	1820-1693		IC-DIGITAL MC14508L CMOS DUAL D-TYPE	04713	MC14508
A13U26	1820-1693		IC-DIGITAL MC14508L CMOS DUAL D-TYPE	04713	MC14508
A13U27	1820-0938		IC-DIGITAL CD4027AE CMOS DUAL J-K	02735	CD4027AY
A13U28	1820-1282	1	IC-DIGITAL SN74LS109N TTL LS DUAL	01295	SN74LS109N
A13U29	1820-1144		IC-DIGITAL SN74LS02N TTL LS QUAD 2 NOR	01295	SN74LS02N
A14	04942-60014	1	ENVELOPE DELAY PC BOARD ASSEMBLY	28480	04942-60014
A14BP1	0340-0060	2	TERMINAL-STUD SPCL-FDTHRU PRESS-MTG	98291	FT-E-15
A14BP2	0340-0060		TERMINAL-STUD SPCL-FDTHRU PRESS-MTG	98291	FT-E-15
A14C1	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A14C2	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A14C3	0180-0228		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A14C4	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C5	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C6	0180-0228		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A14C7	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C8	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C9	0160-0943	2	CAPACITOR-FXD .03UF +-1% 100WVDC MICA	28480	0160-0943
A14C10	0160-0943		CAPACITOR-FXD .03UF +-1% 100WVDC MICA	28480	0160-0943
A14C11	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A14C12	0160-4397	8	CAPACITOR-FXD .1UF +-1% 100WVDC POLYSTY	28480	0160-4397
A14C13	0160-4397		CAPACITOR-FXD .1UF +-1% 100WVDC POLYSTY	28480	0160-4397
A14C14	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C15	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C16	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A14C17	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C18	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C19	0180-0376	1	CAPACITOR-FXD .47UF+-10% 35VDC TA	56289	150D474X9035A2
A14C20	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C21	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C22	0160-3510	5	CAPACITOR-FXD 3UF +-10% 50WVDC MET POLYC	28480	0160-3510
A14C23	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C24	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C25	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C26	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C27	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A14C28	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A14C29	0160-3510		CAPACITOR-FXD 3UF +-10% 50WVDC MET POLYC	28480	0160-3510
A14C30	0180-0228		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A14C31	0180-0228		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A14C32	0160-3510		CAPACITOR-FXD 3UF +-10% 50WVDC MET POLYC	28480	0160-3510
A14C33	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C34	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C35	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C36	0160-4397		CAPACITOR-FXD .1UF +-1% 100WVDC POLYSTY	28480	0160-4397
A14C37	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A14C38	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C39	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C40	0160-4397		CAPACITOR-FXD .1UF +-1% 100WVDC POLYSTY	28480	0160-4397
A14C41	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A14C42	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A14C43	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C44	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C45	0160-0161		CAPACITOR-FXD .01UF +-10% 200WVDC POLYE	56289	292P10392

Table 6-3. Replaceable Parts (15 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A14C46	0160-4397		CAPACITOR-FXD .1UF +-1% 100WVDC POLYSTY	28480	0160-4397
A14C47	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A14C48	0160-4397		CAPACITOR-FXD .1UF +-1% 100WVDC POLYSTY	28480	0160-4397
A14C49	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A14C50	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C51	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A14C52	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A14C53	0160-3510		CAPACITOR-FXD 3UF +-10% 50WVDC MET POLYC	28480	0160-3510
A14C54	0160-2213	1	CAPACITOR-FXD 620PF +-5% 300WVDC MICA	28480	0160-2213
A14CR1	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14CR3	1902-0025		DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	28480	1902-0025
A14CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14CR5	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14CR6	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A14CR7	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A14CR8	1902-0025		DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	28480	1902-0025
A14CR9	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14CR10	1901-0539	1	DIODE-SCHOTTKY	28480	1901-0539
A14JU1	1251-3720	7	CONNECTOR-SGL CONT SKT .04-DIA	28480	1251-3720
A14JU2	1251-3720		CONNECTOR-SGL CONT SKT .04-DIA	28480	1251-3720
A14JU3	1251-3720		CONNECTOR-SGL CONT SKT .04-DIA	28480	1251-3720
A14JU4	1251-3720		CONNECTOR-SGL CONT SKT .04-DIA	28480	1251-3720
A14MP1	0403-0242	2	EXTR-PC BD GRA NYL .062-BD-THKNS	06915	CBE-18
A14MP2	0403-0242		EXTR-PC BD GRA NYL .062-BD-THKNS	06915	CBE-18
A14Q1	1855-0205	1	TRANSISTOR J-FET P-CHAN D-MODE TO-72 SI	17856	VCR3P
A14Q2	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A14Q3	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A14Q4	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A14Q5	1855-0305	1	TRANSISTOR J-FET 2N4117A N-CHAN D-MODE	17856	2N4117A
A14R1	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A14R2	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R3	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R4	0698-3454	6	RESISTOR 215K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2153-F
A14R5	0811-0686		RESISTOR 63.662K .25% .062W PWW TC=0+-20	20940	135
A14R6	0811-0686		RESISTOR 63.662K .25% .062W PWW TC=0+-20	20940	135
A14R7	0811-0686		RESISTOR 63.662K .25% .062W PWW TC=0+-20	20940	135
A14R8	0811-0686		RESISTOR 63.662K .25% .062W PWW TC=0+-20	20940	135
A14R9	0811-0685	4	RESISTOR 19.1K .25% .062W PWW	20940	135
A14R10	0811-0685		RESISTOR 19.1K .25% .062W PWW	20940	135
A14R11	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A14R12	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A14R13	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A14R14	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A14R15	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A14R16	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R17	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A14R18	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A14R19	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A14R20	2100-3109		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-202
A14R21	0757-0440	1	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A14R22	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A14R23	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A14R24	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R25	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A14R26	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A14R27	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A14R28	0757-0460		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A14R29	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A14R30	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A14R31	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R32	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A14R33	0757-0460		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A14R34	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A14R35	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A14R36	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A14R37	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A14R38	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R39	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A14R40	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A14R41	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A14R42	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A14R43	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R44	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R45	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F

Table 6-3. Replaceable Parts (16 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A14R46	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R47	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R48	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A14R49	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R50	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R51	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A14R52	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A14R53	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A14R54	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R55	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R56	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A14R57	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A14R58	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A14R59	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A14R60	0683-3955	1	RESISTOR 3.9M 5% .25W FC TC=-900/+1100	01121	CB3955
A14R61	0698-3460	2	RESISTOR 422K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A14R62	0811-0686		RESISTOR 63.662K .25% .062W PWW TC=0+-20	20940	135
A14R63	0811-0686		RESISTOR 63.662K .25% .062W PWW TC=0+-20	20940	135
A14R64	0698-3460		RESISTOR 422K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A14R65	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A14R66	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A14R67	0698-3162		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A14R68	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A14R69	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A14R70	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A14R71	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A14R72	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A14R73	0757-0485	3	RESISTOR 681K 1% .125W F TC=0+-100	24546	NA4
A14R74	0698-3454		RESISTOR 215K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2153-F
A14R75	0698-3454		RESISTOR 215K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2153-F
A14R76	0811-0685		RESISTOR 19.1K .25% .062W PWW	20940	135
A14R77	0811-0684	1	RESISTOR 17.8K .25% .062W PWW	20940	135
A14R78	2100-3109		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-202
A14R79	0698-6475	6	RESISTOR 19.1K 1% .125W F TC=0+-50	24546	NC55
A14R80	0698-6475		RESISTOR 19.1K 1% .125W F TC=0+-50	24546	NC55
A14R81	0698-3458	1	RESISTOR 348K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A14R82	0757-0485		RESISTOR 681K 1% .125W F TC=0+-100	24546	NA4
A14R83	0698-3454		RESISTOR 215K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2153-F
A14R84	0757-0485		RESISTOR 681K 1% .125W F TC=0+-100	24546	NA4
A14R85	0811-0683	1	RESISTOR 18.2K .25% .062W PWW	20940	135
A14R86	2100-3109		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-202
A14R87	0811-0685		RESISTOR 19.1K .25% .062W PWW	20940	135
A14R88	0698-6475		RESISTOR 19.1K 1% .125W F TC=0+-50	24546	NC55
A14R89	0698-6475		RESISTOR 19.1K 1% .125W F TC=0+-50	24546	NC55
A14R90	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A14R91	0757-0460		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A14R92	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R93	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A14R94	0757-0460		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A14R95	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A14R96	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100°	24546	C4-1/8-T0-2151-F
A14R97	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A14R98	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14TP1	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP2	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP3	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP4	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP5	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP6	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP7	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP8	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP9	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP10	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP11	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14TP12	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A14U1	1820-0493		IC LM 307 OP AMP	27014	LM307N
A14U2	1820-0493		IC LM 307 OP AMP	27014	LM307N
A14U3	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A14U4	1826 0328		IC RV 4558 OP AMP	07933	RV4558DN,
A14U5	1826 0328		IC RV 4558 OP AMP	07933	RV4558DN,
A14U6	1820-0493		IC LM 307 OP AMP	27014	LM307N
A14U7	1820-0493		IC LM 307 OP AMP	27014	LM307N
A14U8	1821-0001		TRANSISTOR ARRAY DIP	02735	CA3046
A14U9	1826-0321		IC CA 3099 COMPARATOR	02735	CA3099E
A14U10	1826-0154		IC-DIGITAL DG200BA CMOS 2-CHAN ANAL	17856	DG200BA

Table 6-3. Replaceable Parts (17 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A14U11	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A14U12	1820-0493		IC LM 307 OP AMP	27014	LM307N
A14U13	1826-0321		IC CA 3099 COMPARATOR	02735	CA3099E
A14U14	1826-0182		IC AD 540J OP AMP	24355	A540J
A14U15	1820-1328		IC-DIGITAL MC14526CP CMOS BIN	04713	MC14526CP
A14U16	1820-0493		IC LM 307 OP AMP	27014	LM307N
A14U17	1820-1330	1	IC-DIGITAL MC14507CP CMOS QUAD 2 EXCL-OR	04713	MC14507CP
A14U18	1820-1317		IC-DIGITAL CD4047AE CMOS MONO/ASTBL	02735	CD4047AY
A14U19	1820-1122	2	IC-DIGITAL MC14518CP CMOS DUAL BCD	04713	MC14518CP
A14U20	1820-1122		IC-DIGITAL MC14518CP CMOS DUAL BCD	04713	MC14518CP
A14U21	1820-0949		IC-DIGITAL CD4011AE CMOS QUAD 2 NAND	02735	CD4011AY
A14U22	1820-0949		IC-DIGITAL CD4011AE CMOS QUAD 2 NAND	02735	CD4011AY
A14U23	1820-1813	1	IC-DIGITAL 34027 CMOS DUAL J-K	07263	34027DC
A14U24	1826-0276	1	IC 78L05AC V RGLTR	04713	MC78L05CP
A14VR1	1990-0449		OPTO-ISOLATOR LAMP-PCNDCT IF=50MA-MAX	03911	CLM8000
A15	04942-60015	1	MICROPROCESSOR PC BOARD ASSEMBLY (NEW)	28480	04942-60015
A15	04942-60115	1	MICROPROCESSOR PC BD ASSY (EXCHANGE)	28480	04942-60115
A15C1	0180-1746		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A15C2	0180-0229	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A15C3	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A15C4	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A15C5	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A15C6	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A15C7	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A15C8	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A15C9	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A15C10	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A15C11	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A15C12	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A15C13	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A15C14	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A15C15	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A15C16	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A15C17	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A15C18	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A15C19	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A15C20	0160-0939		CAPACITOR-FXD 430PF +-5% 300WVDC MICA	28480	0160-0939
A15J1	1251-3141	1	CONNECTOR 50-PIN M RECTANGULAR	76381	3433-1002
A15J2	1251-4429	1	CONNECTOR, 20-CONTACT, MALE	28480	1251-4429
A15MP1	0403-0233	2	EXTR-PC BD NAT NYL .062-BD-THKNS	06915	CBE-8
A15MP2	0403-0233		EXTR-PC BD NAT NYL .062-BD-THKNS	06915	CBE-8
A15R1	0698-0085	5	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A15R2	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A15R3	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A15R4	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A15R5	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A15R6	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A15R7	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A15R8	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A15R9	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A15R10	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A15R11	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A15R12	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A15R13	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A15R14	1810-0135		NETWORK-RES 6-PIN-SIP .15-PIN-SPCG	28480	1810-0135
A15R15	1810-0135		NETWORK-RES 6-PIN-SIP .15-PIN-SPCG	28480	1810-0135
A15R16	1810-0135		NETWORK-RES 6-PIN-SIP .15-PIN-SPCG	28480	1810-0135
A15R17	1810-0041	2	NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0041
A15R18	1810-0041		NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0041
A15R19	1810-0125	2	NETWORK-RES 8-PIN-SIP .125-PIN-SPCG	11236	750
A15R20	1810-0125		NETWORK-RES 8-PIN-SIP .125-PIN-SPCG	11236	750
A15R21	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A15R22	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A15R23	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A15R24	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A15R25	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A15R26	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A15R27	1810-0055		NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0055
A15U1	1820-1356		IC-DIGITAL MC14528CP CMOS DUAL	04713	MC14528CP
A15U2	1820-1201	6	IC-DIGITAL SN74LS08N TTL LS QUAD 2 AND	01295	SN74LS08N
A15U3	1820-1199		IC-DIGITAL SN74LS04N TTL LS HEX 1	01295	SN74LS04N
A15U4	1820-1201		IC-DIGITAL SN74LS08N TTL LS QUAD 2 AND	01295	SN74LS08N
A15U5	1820-1355	1	IC-DIGITAL MC14532CP CMOS	04713	MC14532CP

Table 6-3. Replaceable Parts (18 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A15U6	1820-1202	1	IC-DIGITAL SN74LS10N TTL LS TPL 3 NAND	01295	SN74LS10N
A15U7	1820-1123	1	IC-DIGITAL MK5009N MOS	50088	MK5009N
A15U8	1820-1471	1	IC-DIGITAL MC14539CP CMOS DUAL 4	04713	MC14539CP
A15U9	1820-1201		IC-DIGITAL SN74LS08N TTL LS QUAD 2 AND	01295	SN74LS08N
A15U10	1820-1112	3	IC-DIGITAL SN74LS74N TTL LS DUAL	01295	SN74LS74N
A15U11	1820-1197	3	IC-DIGITAL SN74LS00N TTL LS QUAD 2 NAND	01295	SN74LS00N
A15U12	1820-1199		IC-DIGITAL SN74LS04N TTL LS HEX 1	01295	SN74LS04N
A15U13	1820-1693		IC-DIGITAL MC14508L CMOS DUAL D-TYPE	04713	MC14508
A15U14	1820-1491	3	IC-DIGITAL SN74LS367N TTL LS HEX 1	01295	SN74LS367N
A15U15	1820-1491		IC-DIGITAL SN74LS367N TTL LS HEX 1	01295	SN74LS367N
A15U16	1820-1491		IC-DIGITAL SN74LS367N TTL LS HEX 1	01295	SN74LS367N
A15U17	1820-1199		IC-DIGITAL SN74LS04N TTL LS HEX 1	01295	SN74LS04N
A15U18	1820-1637	1	IC-DIGITAL MC6870A	04713	MC6870A
A15U19	1820-1418	1	IC-DIGITAL SN74LS42N TTL LS 4 BCD-TO-DEC	01295	SN74LS42N
A15U20	1820-0702	1	IC-DIGITAL 93L11DC TTL L 4 4-TO-16-LINE	07263	93L11DC
A15U21	1820-1199		IC-DIGITAL SN74LS04N TTL LS HEX 1	01295	SN74LS04N
A15U22	1820-0757		IC-DIGITAL TTL L	28480	1820-0757
A15U23	1820-1480	1	IC-DIGITAL MC6800L NMOS	04713	MC6800L
A15U24	1820-0757		IC-DIGITAL TTL L	28480	1820-0757
A15U25	1820-0757		IC-DIGITAL TTL L	28480	1820-0757
A15U26	1820-1199		IC-DIGITAL SN74LS04N TTL LS HEX 1	01295	SN74LS04N
A15U27	1820-1198	1	IC-DIGITAL SN74LS03N TTL LS QUAD 2 NAND	01295	SN74LS03N
A15U28	1820-1645	1	IC-DIGITAL SN74LS126N TTL LS QUAD 1	01295	SN74LS126N
A15U29	1820-0634	1	IC-DIGITAL MOS DECD	28480	1820-0634
A15U30	1826-0331	1	IC XC79L12CG V RGLTR	04713	XC79L12CG
A15U31	1826-0332	1	IC XC79L05CG V RGLTR	04713	XC79L05CG
A15U32	1826-0226	1	IC 78M12C V RGLTR	07263	78M12HC
A15U33	1820-1216	1	IC-DIGITAL SN74LS138N TTL LS 3	01295	SN74LS138N
A15U35	1818-0216	1	IC, ROM	28480	1818-0216
A15U36	1818-0217	1	IC, ROM	28480	1818-0217
A15U37	1818-0218	1	IC, ROM	28480	1818-0218
A15U38	1818-0219	1	IC, ROM	28480	1818-0219
A15U39	1818-0220	1	IC, ROM	28480	1818-0220
A15U40	1818-0135	2	IC MC 6810L-1 1K RAM NMOS	04713	MC6810L-1
A15U41	1818-0135		IC MC 6810L-1 1K RAM NMOS	04713	MC6810L-1
A15XU7	1200-0410	2	SOCKET, IC, 16-CONT,DUAL INLINE TYPE	99779	041-001-112
A15XU12	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A15XU17	1200-0474		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A15XU20	1200-0552	2	SOCKET-IC 40-CONT DIP-SLDR	28480	1200-0552
A15XU29	1200-0410		SOCKET, IC, 16-CONT,DUAL INLINE TYPE	99779	041-001-112
A15XU34	1200-0565	9	SOCKET-IC 24-CONT DIP-SLDR-TERMS	28480	1200-0565
A15XU35	1200-0565		SOCKET-IC 24-CONT DIP-SLDR-TERMS	28480	1200-0565
A15XU36	1200-0565		SOCKET-IC 24-CONT DIP-SLDR-TERMS	28480	1200-0565
A15XU37	1200-0565		SOCKET-IC 24-CONT DIP-SLDR-TERMS	28480	1200-0565
A15XU38	1200-0565		SOCKET-IC 24-CONT DIP-SLDR-TERMS	28480	1200-0565
A15XU39	1200-0565		SOCKET-IC 24-CONT DIP-SLDR-TERMS	28480	1200-0565
A15XU40	1200-0565		SOCKET-IC 24-CONT DIP-SLDR-TERMS	28480	1200-0565
A15XU41	1200-0565		SOCKET-IC 24-CONT DIP-SLDR-TERMS	28480	1200-0565
A16	04942-60016	1	HOLDING COIL & WEIGHTING FILTERS PC ASSY	28480	04942-60016
A16C1	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A16C2	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A16C3	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A16C4	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A16C5	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A16C6	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A16C7	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A16C8	0160-2225	1	CAPACITOR-FXD 2000PF +-5% 300WVDC MICA	28480	0160-2225
A16C9	0140-0163	4	CAPACITOR-FXD 4751PF +-1% 300WVDC MICA	72136	DM20F4751F0300WV1CR
A16C10	0140-0163		CAPACITOR-FXD 4751PF +-1% 300WVDC MICA	72136	DM20F4751F0300WV1CR
A16C11	0160-0218	1	CAPACITOR-FXD 2400PF +-1% 300WVDC MICA	28480	0160-0218
A16C12	0160-3291	1	CAPACITOR-FXD 1200PF +-1% 100WVDC MICA	28480	0160-3291
A16C13	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A16C14	0140-0163		CAPACITOR-FXD 4751PF +-1% 300WVDC MICA	72136	DM20F4751F0300WV1CR
A16C15	0140-0163		CAPACITOR-FXD 4751PF +-1% 300WVDC MICA	72136	DM20F4751F0300WV1CR
A16C16	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A16C17	0160-3024	6	CAPACITOR-FXD 1700PF +-1% 100WVDC MICA	28480	0160-3024
A16C18	0160-3024		CAPACITOR-FXD 1700PF +-1% 100WVDC MICA	28480	0160-3024
A16C19	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A16C20	0160-3024		CAPACITOR-FXD 1700PF +-1% 100WVDC MICA	28480	0160-3024
A16C21	0160-3024		CAPACITOR-FXD 1700PF +-1% 100WVDC MICA	28480	0160-3024
A16C22	0160-3024		CAPACITOR-FXD 1700PF +-1% 100WVDC MICA	28480	0160-3024
A16C23	0160-3024		CAPACITOR-FXD 1700PF +-1% 100WVDC MICA	28480	0160-3024
A16C24	0180-2206		CAPACITOR-FXD 60UF+-10% 6VDC TA	56289	150D606X9006B2
A16C25	0180-0228		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2

Table 6-3. Replaceable Parts (19 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A16C26	0180-0228		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A16CR1	1902-0064	2	DIODE-ZNR 7.5V 5% DO-7 PD=.4W TC=+.05%	28480	1902-0064
A16CR2	1901-0029	4	DIODE-PWR RECT 600V 750MA DO-29	28480	1901-0029
A16CR3	1901-0029		DIODE-PWR RECT 600V 750MA DO-29	28480	1901-0029
A16CR4	1901-0029		DIODE-PWR RECT 600V 750MA DO-29	28480	1901-0029
A16CR5	1901-0029		DIODE-PWR RECT 600V 750MA DO-29	28480	1901-0029
A16CR6	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A16MP1	0403-0234		EXTR-PC BD BLK NYL .062-BD-THKNS	06915	CBE-11
A16MP2	1205-0085	1	HEAT SINK TO-66-PKG	28480	1205-0085
A16MP3	9170-0554	2	COVER-TOROID	28480	9170-0554
A16MP4	9170-0554		COVER-TOROID	28480	9170-0554
A16MP5	2360-0195		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	28480	2360-0195
A16MP6	2360-0195		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	28480	2360-0195
A16MP7	2360-0199	1	SCREW-MACH 6-32 .438-IN-LG PAN-HD-POZI	28480	2360-0199
A16MP8	2420-0015		NUT-HEX-W/LKWR 6-32-THD .094-THK .25-A/F	28480	2420-0015
A16MP9	2420-0015		NUT-HEX-W/LKWR 6-32-THD .094-THK .25-A/F	28480	2420-0015
A16MP10	2420-0015		NUT-HEX-W/LKWR 6-32-THD .094-THK .25-A/F	28480	2420-0015
A16Q1	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A16Q2	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A16Q3	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A16Q4	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A16Q5	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A16Q6	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A16Q7	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A16Q8	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A16Q9	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A16Q10	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A16Q11	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A16Q12	1854-0324	1	TRANSISTOR NPN 2N3739 SI TO-66 PD=20W	04713	2N3739
A16Q13	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A16R1	0757-0394	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A16R2	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A16R3	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A16R4	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A16R5	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A16R6	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A16R7	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A16R8	0757-0200		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A16R9	0698-6902	1	RESISTOR 34K .5% .125W F TC=0+-50	24546	NC55
A16R10	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A16R11	2100-3154	6	RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-102
A16R12	0698-8695	1	RESISTOR 36K .1% .125W F TC=0+-25	24546	NE55
A16R13	0698-7339	3	RESISTOR 72K .25% .125W F TC=0+-50	19701	MF4C1/8-T2-7202-C
A16R14	0698-4339	1	RESISTOR 11.111K .1% .125W F TC=0+-50	24546	NC55
A16R15	0698-6360		RESISTOR 10K .1% .125W F TC=0+-25	24546	NE55
A16R16	0698-6423	2	RESISTOR 31.25K .1% .125W F TC=0+-25	24546	NE55
A16R17	0698-6423		RESISTOR 31.25K .1% .125W F TC=0+-25	24546	NE55
A16R18	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A16R19	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A16R20	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A16R21	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A16R22	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A16R23	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A16R24	0698-3451	1	RESISTOR 133K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1333-F
A16R25	0757-0463		RESISTOR 82.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8252-F
A16R26	0698-8696	2	RESISTOR 83.9K .1% .125W F TC=0+-25	24546	NE55
A16R27	0698-8696		RESISTOR 83.9K .1% .125W F TC=0+-25	24546	NE55
A16R28	0698-8697	1	RESISTOR 34.6K 1% .125W F TC=0+-100	24546	C4
A16R29	0698-6360		RESISTOR 10K .1% .125W F TC=0+-25	24546	NE55
A16R30	0698-6360		RESISTOR 10K .1% .125W F TC=0+-25	24546	NE55
A16R31	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A16R32	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A16R33	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A16R34	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A16R35	0698-3452		RESISTOR 147K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1473-F
A16R36	0698-3452		RESISTOR 147K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1473-F
A16R37	0698-8162	1	RESISTOR 11.8K .25% .125W F TC=0+-50	19701	MF4C1/8-T2-1182-C
A16R38	0698-6360		RESISTOR 10K .1% .125W F TC=0+-25	24546	NE55
A16R39	0698-7850	1	RESISTOR 9.455K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-9455R-B
A16R40	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A16R41	2100-3154		RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-102
A16R42	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1211-F
A16R43	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A16R44	0698-3243	1	RESISTOR 178K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1783-F
A16R45	0698-3454		RESISTOR 215K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2153-F
A16R46	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F

Table 6-3. Replaceable Parts (20 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A16R47	0698-3433	1	RESISTOR 28.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-28R7-F
A16R48	0698-7339		RESISTOR 72K .25% .125W F TC=0+-50	19701	MF4C1/8-T2-7202-C
A16R49	0698-7339		RESISTOR 72K .25% .125W F TC=0+-50	19701	MF4C1/8-T2-7202-C
A16R50	2100-3154		RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-102
A16R51	0698-7376	1	RESISTOR 11.397K .1% .125W F TC=0+-50	19701	MF4C1/8-T2-11397R-B
A16R52	0698-6360		RESISTOR 10K .1% .125W F TC=0+-25	24546	NE55
A16R53	0698-6360		RESISTOR 10K .1% .125W F TC=0+-25	24546	NE55
A16R54	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A16R55	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A16R56	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A16T1	9100-3822	1	CORE-TOROID (846T)	28480	9100-3822
A16U1	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A16U2	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A16U3	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A16U4	1826-0154		IC-DIGITAL DG200BA CMOS 2-CHAN ANAL	17856	DG200BA
A17	04942-60017	1	NOTCH FILTER & PROGRAMMABLE AMP PC BD	28480	04942-60017
A17C1	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A17C2	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A17C3	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A17C4	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A17C5	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A17C6	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A17C7	0160-4136	2	CAPACITOR-FXD 3300PF +-1% 500WVDC MICA	28480	0160-4136
A17C8	0160-3548		CAPACITOR-FXD .01UF +-1% 100WVDC MICA	28480	0160-3548
A17C9	0160-3879	8	CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A17C10	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A17C11	0160-3548		CAPACITOR-FXD .01UF +-1% 100WVDC MICA	28480	0160-3548
A17C12	0160-3548		CAPACITOR-FXD .01UF +-1% 100WVDC MICA	28480	0160-3548
A17C13	0160-4135	1	CAPACITOR-FXD 4700PF +-1% 300WVDC MICA	28480	0160-4135
A17C14	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A17C15	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A17C16	0160-3548		CAPACITOR-FXD .01UF +-1% 100WVDC MICA	28480	0160-3548
A17C17	0160-3548		CAPACITOR-FXD .01UF +-1% 100WVDC MICA	28480	0160-3548
A17C18	0160-4136		CAPACITOR-FXD 3300PF +-1% 500WVDC MICA	28480	0160-4136
A17C19	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A17C20	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A17C21	0160-3548		CAPACITOR-FXD .01UF +-1% 100WVDC MICA	28480	0160-3548
A17C22	0160-0127		CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A17C23	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A17C24	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A17C25	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A17C26	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A17C27	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A17C28	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A17CR1	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17J1			NOT ASSIGNED		
A17J2	1200-0767		SOCKET-IC 16-CONT DIP-SLDR-TERMS	91506	316-AG50-3R
A17J3	1200-0564		SOCKET-IC 8-CONT DIP-SLDR-TERMS	28480	1200-0564
A17MP1	0403-0235	1	EXTR-PC BD BRN NYL .062-BD-THKNS	06915	CBE-12
A17R1	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A17R2	0757-0482	4	RESISTOR 511K 1% .125W F TC=0+-100	24546	NA4
A17R3	0698-6475		RESISTOR 19.1K 1% .125W F TC=0+-50	24546	NC55
A17R4	2100-3109		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-202
A17R5	0698-6465	1	RESISTOR 11K 1% .125W F TC=0+-50	24546	NC55
A17R6	2100-3109		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-202
A17R7	0698-6464	2	RESISTOR 8.06K 1% .125W F TC=0+-50	24546	NC55
A17R8	0698-6474	3	RESISTOR 19.6K 1% .125W F TC=0+-50	24546	NC55
A17R9	0698-6469	3	RESISTOR 5.11K 1% .125W F TC=0+-50	24546	NC55
A17R10	0698-3152	4	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A17R11	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A17R12	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A17R13	0698-6466	1	RESISTOR 14.7K 1% .125W F TC=0+-50	24546	NC55
A17R14	2100-3109		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-202
A17R15	0698-6474		RESISTOR 19.6K 1% .125W F TC=0+-50	24546	NC55
A17R16	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-502
A17R17	0698-6468	1	RESISTOR 51.1K 1% .125W F TC=0+-50	24546	NC55
A17R18	0698-6467	1	RESISTOR 16.9K 1% .125W F TC=0+-50	24546	NC55
A17R19	0698-6469		RESISTOR 5.11K 1% .125W F TC=0+-50	24546	NC55
A17R20	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F

Table 6-3. Replaceable Parts (21 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A17R21	0698-3162		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A17R22	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A17R23	0698-6475		RESISTOR 19.1K 1% .125W F TC=0+-50	24546	NC55
A17R24	2100-3109		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-202
A17R25	0757-0201	1	RESISTOR 6.81K 1% .125W F TC=0+-50	19701	MFAC1/8-T2-6811-F
A17R26	2100-3109		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-202
A17R27	0698-6474		RESISTOR 19.6K 1% .125W F TC=0+-50	24546	NC55
A17R28	0698-6469		RESISTOR 5.11K 1% .125W F TC=0+-50	24546	NC55
A17R29	0698-6464		RESISTOR 8.06K 1% .125W F TC=0+-50	24546	NC55
A17R30	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A17R31	0698-3152		RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A17R32	0698-4478	1	RESISTOR 10.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1072-F
A17R33	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A17R34	1810-0223		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	56289	216CM-126-CRR
A17R35	1810-0223		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	56289	216CM-126-CRR
A17R36	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17R37	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17R38	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17R39	1810-0223		NETWORK-RES 8-PIN-SIP .1-PIN-SPCG	56289	216CM-126-CRR
A17R40	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A17R41	1810-0245	1	NETWORK-RES 16-PIN-DIP .1-PIN-SPCG	28480	1810-0245
A17R42	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A17R43	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17R44	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17R45	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17R46	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17R47	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A17R48	0698-4479	1	RESISTOR 14K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1402-F
A17R49	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A17R50	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A17R51	0757-0461		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A17R52	2100-3056		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-502
A17R53	0757-0465		RESISTOR 100K 1% .125W TC=0+-100	24546	C4-1/8-T0-1003-F
A17U1	1826-0013	10	IC 741 OP AMP	28480	1826-0013
A17U2	1826-0013		IC 741 OP AMP	28480	1826-0013
A17U3	1826-0013		IC 741 OP AMP	28480	1826-0013
A17U4	1826-0013		IC 741 OP AMP	28480	1826-0013
A17U5	1826-0013		IC 741 OP AMP	28480	1826-0013
A17U6	1826-0013		IC 741 OP AMP	28480	1826-0013
A17U7	1826-0013		IC 741 OP AMP	28480	1826-0013
A17U8	1826-0013		IC 741 OP AMP	28480	1826-0013
A17U9	1826-0013		IC 741 OP AMP	28480	1826-0013
A17U10	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A17U11	1820-0493		IC LM 307 OP AMP	27014	LM307N
A17U12	1826-0013		IC 741 OP AMP	28480	1826-0013
A17U13	1820-0493		IC LM 307 OP AMP	27014	LM307N
A17U14	1820-1374	1	IC-DIGITAL AD7510N CMOS QUAD ANALOG	24355	AD7510N
A17U15	1820-1145	1	IC-DIGITAL CD4049AE CMOS HEX 1 INV	02735	CD4049AY
A17U16	1820-0951	1	IC-DIGITAL CD4019AE CMOS QUAD 2	02735	CD4019AY
A17U17	1820-1315		IC-DIGITAL CD4051BE CMOS	02735	CD4051BY
A17U18	1820-0946		IC-DIGITAL CD4001AE CMOS QUAD 2 NOR	02735	CD4001AY
A17U19	1820-1693		IC-DIGITAL MC14508L CMOS DUAL D-TYPE	04713	MC14508
A17U20	1820-0493		IC LM 307 OP AMP	27014	LM307N
A17U21	1820-0493		IC LM 307 OP AMP	27014	LM307N
A17U22	1826-0154		IC-DIGITAL DG200BA CMOS 2-CHAN ANAL	17856	DG200BA
A17U23	1820-1315		IC-DIGITAL CD4051BE CMOS	02735	CD4051BY
A17U24	1820-0493		IC LM 307 OP AMP	27014	LM307N
A17U25	1826-0154		IC DIGITAL DG200BA CMOS	17856	DG200BA
A17XU19	1200-0431	1	SOCKET-IC 24-CONT	06776	IC-246-82
A18	04942-60018	1	DETECTORS & LOG QUANTIZER PC BD ASSY	28480	04942-60018
A18C1	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A18C2	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A18C3	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A18C4	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A18C5	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A18C6	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A18C7	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A18C8	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A18C9	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A18C10	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A18C11	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A18C12	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A18C13	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A18C14	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A18C15	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082

Table 6-3. Replaceable Parts (22 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A18C16	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A18C17	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X902082
A18C18	0180-0291		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A18C19	0160-4397		CAPACITOR-FXD .1UF +-1% 100WVDC POLYSTY	28480	0160-4397
A18C20	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A18C21	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A18C22	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A18C23	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A18C24	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A18C25	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A18C26	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A18C27	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A18C28	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A18C29	0160-4397		CAPACITOR-FXD .1UF +-1% 100WVDC POLYSTY	28480	0160-4397
A18CR1	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A18CR2	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A18CR3	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A18CR4	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A18CR5	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A18CR6	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A18CR7	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A18CR8	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A18CR9	1901-0376		DIODE-GEN PRP 35V 50MA DO-7	28480	1901-0376
A18CR10	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A18CR11	1902-0064		DIODE-ZNR 7.5V 5% DO-7 PD=.4W TC=+.05%	28480	1902-0064
A18CR12	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A18CR13	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A18MP1	0403-0238		EXTR-PC BD RED NYL .062-BD-THKNS	06915	CBE-13
A18Q1	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A18Q2	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A18R1	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R2	0698-3153		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3831-F
A18R3	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R4	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R5	2100-3162	1	RESISTOR-TRMR 200K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-204
A18R6	0698-3454		RESISTOR 215K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2153-F
A18R7	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A18R8	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R9	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R10	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A18R11	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A18R12	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A18R13	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A18R14	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A18R15	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A18R16	0698-4475	1	RESISTOR 9.76K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-9761-F
A18R17	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A18R18	2100-3109		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-202
A18R19	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A18R20	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A18R21	0698-4002		RESISTOR 5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5001-F
A18R22	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A18R23	2100-3109		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-202
A18R24	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R25	0698-3152		RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A18R26	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A18R27	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A18R28	0757-0424	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A18R29	0698-6360		RESISTOR 10K .1% .125W F TC=0+-25	24546	NE55
A18R30	0698-6360		RESISTOR 10K .1% .125W F TC=0+-25	24546	NE55
A18R31	2100-3103		RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-103
A18R32	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A18R33	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A18R34	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R35	0698-8343	1	RESISTOR 590K 1% .125W F TC=0+-100	19701	MF5C1/8-T0-5903-F
A18R36	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R37	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R38	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R39	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R40	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R41	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R42	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A18R43	2100-3095	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 17-TRN	32997	3006P-1-201
A18R44	0757-0278		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A18R45	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F

Table 6-3. Replaceable Parts (23 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A18R46	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A18R47	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A18R48	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A18R49	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A18R50	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R51	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R52	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R53	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A18R54	0698-3151	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A18R55	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A18R56	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A18R57	2100-3123	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	32997	3006P-1-501
A18R58	0811-0125	1	RESISTOR 8.5435K .1% .25W PWW	24294	VA12-1/4-E-8543R5-B
A18U1	1826-0309		IC AD 518J OP AMP	24355	AD518J
A18U2	1820-1315		IC-DIGITAL CD4051BE CMOS	02735	CD4051BY
A18U3	1820-0493		IC LM 307 OP AMP	27014	LM307N
A18U4	1820-0493		IC LM 307 OP AMP	27014	LM307N
A18U5	1826-0183	2	IC UA 734C COMPARATOR	07263	734HC
A18U6	1820-0493		IC LM 307 OP AMP	27014	LM307N
A18U7	1820-0493		IC LM 307 OP AMP	27014	LM307N
A18U8	1826-0183		IC UA 734C COMPARATOR	07263	734HC
A18U9	1820-0944		IC-DIGITAL CD4025AE CMOS TPL 3 NOR	02735	CD4025AY
A18U10	1826-0065	1	IC LM 311 COMPARATOR	27014	LM311N
A18U11	1820-1317		IC-DIGITAL CD4047AE CMOS MONO/ASTBL	02735	CD4047AY
A19	04942-60019	1	FREQUENCY TRACKING LOOP PC BOARD ASSY	28480	04942-60019
A19C1	0180-0141	2	CAPACITOR-FXD 50UF+75-10% 50VDC AL	56289	30D506G050DD2
A19C2	0180-0141		CAPACITOR-FXD 50UF+75-10% 50VDC AL	56289	30D506G050DD2
A19C3	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A19C4	0160-2216	2	CAPACITOR-FXD 820PF +-5% 300WVDC MICA	28480	0160-2216
A19C5	0160-4137	2	CAPACITOR-FXD .01UF +-1% 100WVDC POLYSTY	84411	863UW
A19C6	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A19C7	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A19C8	0160-2216		CAPACITOR-FXD 820PF +-5% 300WVDC MICA	28480	0160-2216
A19C9	0160-4137		CAPACITOR-FXD .01UF +-1% 100WVDC POLYSTY	84411	863UW
A19C10	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A19C11	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A19C12	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A19C13	0160-3902		CAPACITOR-FXD .1UF +-10% 200WVDC POLYC	84411	MEW-273
A19C14	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A19C15	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A19C16	0160-2217	2	CAPACITOR-FXD 910 PF +-5% 300 WVDC MICA	28480	0160-2217
A19C17	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A19C18	0160-2217		CAPACITOR-FXD 910 PF +-5% 300 WVDC MICA	28480	0160-2217
A19C19	0160-3902		CAPACITOR-FXD .1UF +-10% 200WVDC POLYC	84411	MEW-273
A19C20	0160-3902		CAPACITOR-FXD .1UF +-10% 200WVDC POLYC	84411	MEW-273
A19C21	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A19C22	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A19C23	0160-3902		CAPACITOR-FXD .1UF +-10% 200WVDC POLYC	84411	MEW-273
A19C24	0160-3902		CAPACITOR-FXD .1UF +-10% 200WVDC POLYC	84411	MEW-273
A19C25	0160-3510		CAPACITOR-FXD 3UF +-10% 50WVDC MET POLYC	28480	0160-3510
A19C26	0160-3071		CAPACITOR-FXD 10UF +-10% 100WVDC MET	00853	17UB106K
A19C27	0180-0291		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A19C28	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A19C29	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A19C30	0160-2723	1	CAPACITOR-FXD 3900PF +-2% 500WVDC MICA	28480	0160-2723
A19C31	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A19C32	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A19C33	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A19C34	0180-0291		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A19C35	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A19C36	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A19C37	0160-2259	1	CAPACITOR-FXD 12PF +-5% 500WVDC CER	28480	0160-2259
A19CR1	1902-3036	2	DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	04713	SZ 10939-38
A19CR2	1902-3036		DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	04713	SZ 10939-38
A19CR3	1902-3182	1	DIODE-ZNR 12.1V 5% DO-7 PD=.4W TC=+.064%	28480	1902-3182
A19CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR5	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR6	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR7	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR8	1902-3114	1	DIODE-ZNR 6.19V 2% DO-7 PD=.4W TC=+.022%	04713	SZ 10939-123
A19JU1	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19JU1	1251-3720		CONNECTOR-SGL CONT SKT .04-DIA	28480	1251-3720
A19JU2	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19JU2	1251-3720		CONNECTOR-SGL CONT SKT .04-DIA	28480	1251-3720

Table 6-3. Replaceable Parts (24 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A19MP1	0403-0236		EXTR-PC BD ORN NYL .062-BD-THKNS	06915	CBE-14
A19Q1	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A19Q2	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A19Q3	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A19Q4	1855-0078		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0078
A19Q5	1855-0082	1	TRANSISTOR MOSFET P-CHAN D-MODE SI	28480	1855-0082
A19Q6	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A19Q7	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A19Q8	1854-0019	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A19R1	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A19R2	0757-0459		RESISTOR 56.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5622-F
A19R3	0757-0470	1	RESISTOR 162K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1623-F
A19R4	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A19R5	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A19R6	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A19R7	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A19R8	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A19R9	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R10	0757-1094	2	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A19R11	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A19R12	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A19R13	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A19R14	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R15	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A19R16	0698-3440	2	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A19R17	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A19R18	0757-0460		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A19R19	0757-0460		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A19R20	0757-0460		RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A19R21	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A19R22	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A19R23	2100-3161		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-203
A19R24	0757-0463		RESISTOR 82.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8252-F
A19R25	0757-0464		RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A19R26	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R27	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R28	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R29	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R30	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A19R31	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A19R32	0757-0482		RESISTOR 511K 1% .125W F TC=0+-100	24546	NAA
A19R33	0757-0482		RESISTOR 511K 1% .125W F TC=0+-100	24546	NAA
A19R34	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R35	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R36	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A19R37	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R38	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R39	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A19R40	0683-2055		RESISTOR 2M 5% .25W FC TC=-900/+1100	01121	CB2055
A19R41	0698-3453		RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F
A19R42	0683-2055		RESISTOR 2M 5% .25W FC TC=-900/+1100	01121	CB2055
A19R43	0683-2055		RESISTOR 2M 5% .25W FC TC=-900/+1100	01121	CB2055
A19R44	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R45	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R46	0698-3152		RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A19R47	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A19R48	0698-3447	2	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A19R49	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A19R50	0698-3447		RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A19R51	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A19R52	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A19R53	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A19R54	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R55	0757-0482		RESISTOR 511K 1% .125W F TC=0+-100	24546	NAA
A19R56	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A19R57	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A19R58	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A19R59	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A19TP1	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19TP2	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19TP3	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19TP4	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19TP5	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124

Table 6-3. Replaceable Parts (25 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A19TP6	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19TP7	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19TP8	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19TP9	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19TP10	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19TP11	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A19U1	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN
A19U2	1826-0321		IC CA 3099 COMPARATOR	02735	CA3099E
A19U3	1820-0947	1	IC-DIGITAL CD4030AE CMOS QUAD 2 EXCL-OR	02735	CD4030AY
A19U4	1826-0003	1	IC MC 1456C OP AMP	04713	MC1456CG
A19U5	1826-0180		IC NE 555 TIMER	18324	NE555V
A19U6	1820-1932		IC-DIGITAL MC14538BCP CMOS DUAL	04713	MC14538BCP
A19U7	1820-0493		IC LM 307 OP AMP	27014	LM307N
A19U8	1820-0938		IC-DIGITAL CD4027AE CMOS DUAL J-K	02735	CD4027AY
A19U9	1820-1328		IC-DIGITAL MC14526CP CMOS BIN	04713	MC14526CP
A19U10	1826-0275	2	IC 78L12AC V RGLTR	04713	MC78L12CP
A19U11	1820-1356		IC-DIGITAL MC14528CP CMOS DUAL	04713	MC14528CP
A19U12	1820-0949		IC-DIGITAL CD4011AE CMOS QUAD 2 NAND	02735	CD4011AY
A19U13	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A19U14	1826-0154		IC-DIGITAL DG200BA CMOS 2-CHAN ANAL	17856	DG200BA
A19U15	1820-0493		IC LM 307 OP AMP	27014	LM307N
A20			NOT ASSIGNED		
A21	04942-60021	1	HP-IB PC BOARD ASSEMBLY (OPTION 010)	28480	04942-60021
A21C1	0160-2145	2	CAPACITOR-FXD 5000PF +80-20% 100WVDC CER	28480	0160-2145
A21C2	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A21C3	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A21C4	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A21C5	0160-2145		CAPACITOR-FXD 5000PF +80-20% 100WVDC CER	28480	0160-2145
A21C6	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A21C7	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A21C8	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A21C9	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A21C10	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A21C11	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A21C12	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A21C13	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A21J1	1251-4058	1	CONNECTOR 26-PIN M RECTANGULAR	76381	3429-1002
A21J2	1200-0767		SOCKET, IC, 16-PIN	28480	1200-0767
A21MP1	0403-0237		EXTR-PC BD GREEN NYL .062-BD-THKNS	06915	CBE-16
A21R1	0757-0403		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A21R2	0698-3452		RESISTOR 147K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1473-F
A21R3	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A21R4	1810-0055		NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0055
A21R5	1810-0135		NETWORK-RES 6-PIN-SIP .15-PIN-SPCG	28480	1810-0135
A21R6	0757-0403		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A21R7	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A21R8	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A21R9	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A21S1	3101-1826	1	SWITCH-TGL DIP ROCKER ASSEMBLY 7-1A NS	00779	435166-1
A21U1	1826-0275		IC 78L12AC V RGLTR	04713	MC78L12CP
A21U2	1820-0904	1	IC-DIGITAL 93L24DC TTL L MAGTD	07263	93L24DC
A21U3	1820-1689	4	IC-DIGITAL MC3446P QUAD	04713	MC3446P
A21U4	1820-1689		IC-DIGITAL MC3446P QUAD	04713	MC3446P
A21U5	1820-1689		IC-DIGITAL MC3446P QUAD	04713	MC3446P
A21U6	1820-1689		IC-DIGITAL MC3446P QUAD	04713	MC3446P
A21U7	1820-1481	1	IC-DIGITAL MC6820L NMOS	04713	MC6820L
A21U8	1820-0757		IC-DIGITAL TTL L	28480	1820-0757
A21U9	1820-1199		IC-DIGITAL SN74LS04N TTL LS HEX 1	01295	SN74LS04N
A21U10	1820-1201		IC-DIGITAL SN74LS08N TTL LS QUAD 2 AND	01295	SN74LS08N
A21U11	1820-1200	1	IC-DIGITAL SN74LS05N TTL LS HEX 1	01295	SN74LS05N
A21U12	1818-2275	1	IC, ROM, 512 X 8	28480	1818-2275
A21U13	1820-1201		IC-DIGITAL SN74LS08N TTL LS QUAD 2 AND	01295	SN74LS08N
A21U14	1820-1112		IC-DIGITAL SN74LS74N TTL LS DUAL	01295	SN74LS74N
A21U15	1820-1208	1	IC-DIGITAL SN74LS32N TTL LS QUAD 2 OR	01295	SN74LS32N
A21U16	1820-1201		IC-DIGITAL SN74LS08N TTL LS QUAD 2 AND	01295	SN74LS08N
A21U17	1820-1203	2	IC-DIGITAL SN74LS11N TTL LS TPL 3 AND	01295	SN74LS11N
A21U18	1820-1212	1	IC-DIGITAL SN74LS112N TTL LS DUAL	01295	SN74LS112N
A21U19	1820-1197		IC-DIGITAL SN74LS00N TTL LS QUAD 2 NAND	01295	SN74LS00N
A21U20	1820-1197		IC-DIGITAL SN74LS00N TTL LS QUAD 2 NAND	01295	SN74LS00N

Table 6-3. Replaceable Parts (26 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A21U21	1820-1203		IC-DIGITAL SN74LS11N TTL LS TPL 3 AND	01295	SN74LS11N
A21U22	1820-1112		IC-DIGITAL SN74LS74N TTL LS DUAL	01295	SN74LS74N
A21U23	1820-0708	1	IC-DIGITAL 93L09DC TTL L DUAL 4	07263	93L09DC
A21XU7	1200-0552		SOCKET-IC 40-CONT DIP-SLDR	28480	1200-0552
A21XU12	1200-0565		SOCKET-IC 24-CONT DIP-SLDR-TERMS	28480	1200-0565
A22			NOT ASSIGNED		
A23	04942-60023	1	POWER SUPPLY PC BOARD ASSEMBLY	28480	04942-60023
A23C1	0180-2629	1	CAPACITOR-FXD .01F+75-10% 16VDC AL	56289	43D103G016LP1
A23C2	0180-2082	2	CAPACITOR-FXD 4000UF+75-10% 25VDC AL	56289	39D408G025JS4
A23C3	0180-2082		CAPACITOR-FXD 4000UF+75-10% 25VDC AL	56289	39D408G025JS4
A23C4	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A23C5	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A23C6	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A23C7	0180-0104		CAPACITOR-FXD 200UF+75-10% 16VDC AL	56289	30D207G016DF2
A23C8	0180-0094	2	CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	30D107G025DD2
A23C9	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A23C10	0180-0104		CAPACITOR-FXD 200UF+75-10% 16VDC AL	56289	30D207G016DF2
A23C11	0180-0104		CAPACITOR-FXD 200UF+75-10% 16VDC AL	56289	30D207G016DF2
A23C12	0160-3060	3	CAPACITOR-FXD .1UF +-20% 25WVDC CER	28480	0160-3060
A23C13	0160-3060		CAPACITOR-FXD .1UF +-20% 25WVDC CER	28480	0160-3060
A23C14	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A23C15	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A23C16	0160-3060		CAPACITOR-FXD .1UF +-20% 25WVDC CER	28480	0160-3060
A23C17	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A23C18	0160-3451		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-3451
A23C19	0180-0094		CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	30D107G025DD2
A23C20	0160-0128	3	CAPACITOR-FXD 2.2UF +-20% 50WVDC CER	28480	0160-0128
A23C21	0160-0128		CAPACITOR-FXD 2.2UF +-20% 50WVDC CER	28480	0160-0128
A23C22	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A23C23	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A23C24	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A23C25	0160-0128		CAPACITOR-FXD 2.2UF +-20% 50WVDC CER	28480	0160-0128
A23C26	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A23CR1	1901-0754	4	DIODE-PWR RECT 50V 5A SUS	03508	A15F
A23CR2	1901-0754		DIODE-PWR RECT 50V 5A SUS	03508	A15F
A23CR3	1901-0754		DIODE-PWR RECT 50V 5A SUS	03508	A15F
A23CR4	1901-0754		DIODE-PWR RECT 50V 5A SUS	03508	A15F
A23CR5	1906-0028	2	DIODE-FW BRDG 100V 1.8A	04713	MDA922-3
A23CR6	1906-0028		DIODE-FW BRDG 100V 1.8A	04713	MDA922-3
A23CR7	1902-0692	1	DIODE-ZNR 6.3V 1% DO-7 PD=.4W TC=+.001%	28480	1902-0692
A23CR8	1884-0250	3	THYRISTOR-TRIAC TO-220AB	02735	T2500B
A23CR9	1884-0250		THYRISTOR-TRIAC TO-220AB	02735	T2500B
A23CR10	1884-0250		THYRISTOR-TRIAC TO-220AB	02735	T2500B
A23CR11	1902-0202	1	DIODE-ZNR 15V 5% DO-15 PD=1W TC=+.057%	28480	1902-0202
A23CR12	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A23CR13	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A23CR14	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A23CR15	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A23CR16	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A23J1	1251-4271	1	CONNECTOR 10-PIN M UTILITY	28480	1251-4271
A23JU1	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A23JU1	1251-3720		CONNECTOR-SGL CONT SKT .04-DIA	28480	1251-3720
A23MP1	2360-0193	1	SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI	28480	2360-0193
A23MP2	2420-0015		NUT-HEX-W/LKWR 6-32-THD .094-THK .25-A/F	28480	2420-0015
A23Q1	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A23Q2	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A23Q3	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A23R1	0757-0814	1	RESISTOR 511 1% .5W F TC=0+-100	19701	MF7C1/2-T0-511R-F
A23R2	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A23R3	0698-3410	2	RESISTOR 3.16K 1% .5W F TC=0+-100	91637	MFF-1/2-10
A23R4	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A23R5	0698-3410		RESISTOR 3.16K 1% .5W F TC=0+-100	91637	MFF-1/2-10
A23R6	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A23R7	0757-0418	1	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A23R8	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A23R9	0698-8463	2	RESISTOR 484.2 .1% .125W F TC=0+-25	24546	NE55
A23R10	0698-8463		RESISTOR 484.2 .1% .125W F TC=0+-25	24546	NE55

Table 6-3. Replaceable Parts (27 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A23R11	0698-7870	1	RESISTOR 1.59K .25% .125W F TC=0+-100	19701	MF4C1/8-T0-1591-C
A23R12	0698-7862	1	RESISTOR 9.9K .25% .125W F TC=0+-100	19701	MF4C1/8-T0-9901-C
A23R13	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R14	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A23R15	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R16	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R17	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R18	0698-3540	2	RESISTOR 15.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1542-F
A23R19	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R20	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R21	0698-3540		RESISTOR 15.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1542-F
A23R22	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R23	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R24	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R25	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R26	0757-0439	2	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A23R27	2100-3154		RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-102
A23R28	0757-0441	1	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A23R29	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A23R30	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R31	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1962-F
A23R32	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R33	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A23R34	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A23R35	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A23R36	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A23R37	2100-3154		RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-102
A23R38	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A23R39	0698-3166	2	RESISTOR 6.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6481-F
A23R40	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R41	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A23R42	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A23R43	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A23R44	2100-3154		RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-102
A23R45	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A23R46	0698-3166		RESISTOR 6.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6481-F
A23R47	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R48	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A23R49	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4222-F
A23U1			NOT ASSIGNED		
A23U2	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A23U3	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A23U4	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,
A23U5	1826-0328		IC RV 4558 OP AMP	07933	RV4558DN,

Table 6-3. Replaceable Parts (28 of 38)

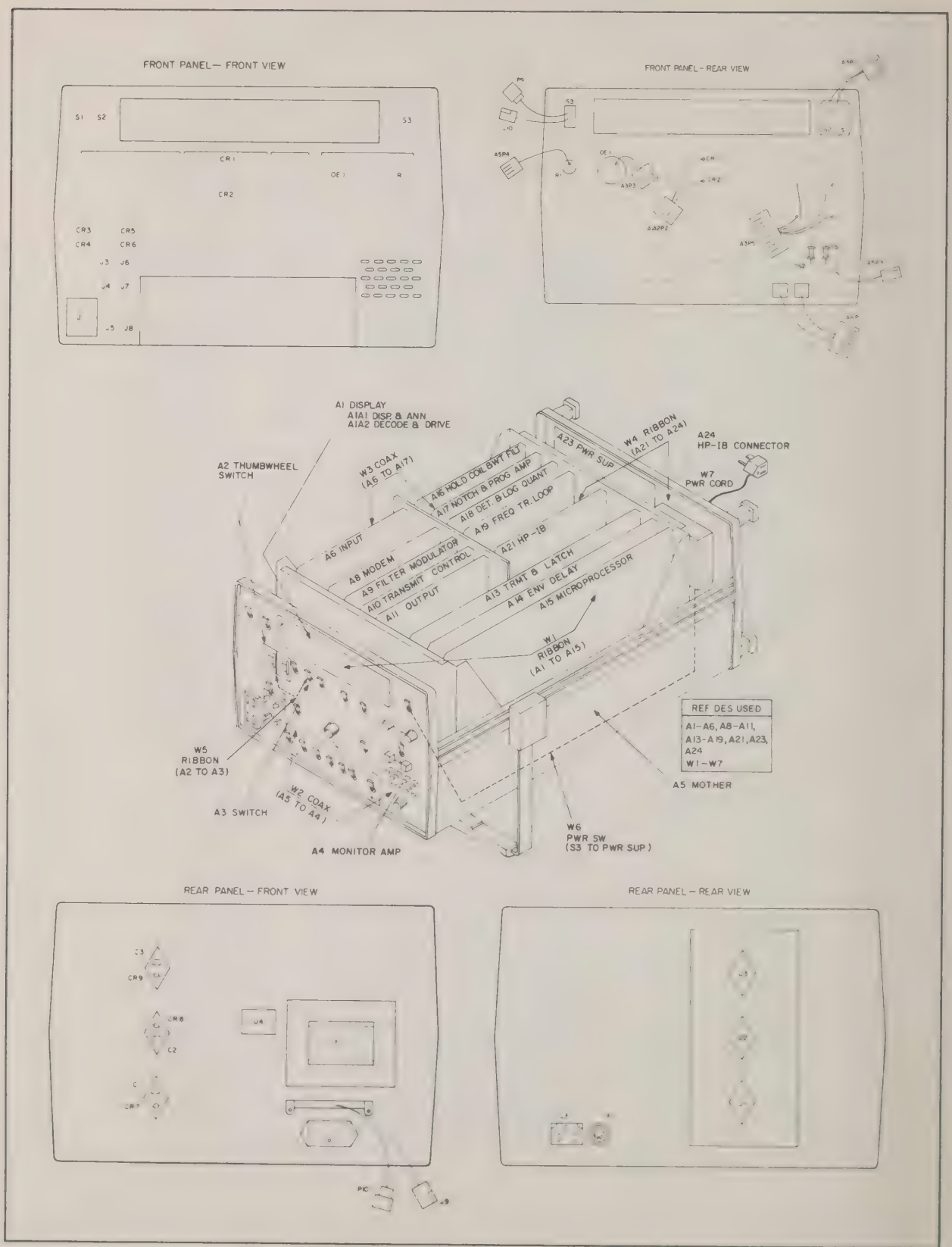


Table 6-3. Replaceable Parts (29 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			CHASSIS MOUNTED ELECTRICAL COMPONENTS		
C1	0160-0174	3	CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
C2	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
C3	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
CR1	1990-0442	6	LED-VISIBLE LUM-INT=300UCD IF=50MA-MAX	28480	1990-0442
CR2	1990-0442		LED-VISIBLE LUM-INT=300UCD IF=50MA-MAX	28480	1990-0442
CR3	1990-0442		LED-VISIBLE LUM-INT=300UCD IF=50MA-MAX	28480	1990-0442
CR4	1990-0442		LED-VISIBLE LUM-INT=300UCD IF=50MA-MAX	28480	1990-0442
CR5	1990-0442		LED-VISIBLE LUM-INT=300UCD IF=50MA-MAX	28480	1990-0442
CR6	1990-0442		LED-VISIBLE LUM-INT=300UCD IF=50MA-MAX	28480	1990-0442
CR7	1901-0696	3	DIODE-PWR RECT 400V 2A 200NS	28480	1901-0696
CR8	1901-0696		DIODE-PWR RECT 400V 2A 200NS	28480	1901-0696
CR9	1901-0696		DIODE-PWR RECT 400V 2A 200NS	28480	1901-0696
DS1	1970-0050	2	TUBE ELCTRN B1-A230 SURGE V PTCTR	3M768	B1-A230
DS2	1970-0050		TUBE ELCTRN B1-A230 SURGE V PTCTR	3M768	B1-A230
F1	2110-0063	1	FUSE .75A 250V FAST-BLO 1.25X.25 UL IEC	75915	312.750
J1	5060-7452	1	CONNECTOR, 2-CONT, DIAL	28480	5060-7452
J2			NOT ASSIGNED		
J3	1510-0090	4	BINDING POST SGL SGL-TUR JGK	28480	1510-0090
J4	1510-0090		BINDING POST SGL SGL-TUR JGK	28480	1510-0090
J5	1251-3677	2	CONNECTOR-TEL JACK 3-CKTS .25-SHK-DIA	28480	1251-3677
J6	1510-0090		BINDING POST SGL SGL-TUR JGK	28480	1510-0090
J7	1510-0090		BINDING POST SGL SGL-TUR JGK	28480	1510-0090
J8	1251-3677		CONNECTOR-TEL JACK 3-CKTS .25-SHK-DIA	28480	1251-3677
J9	1251-2510	2	CONNECTOR 2-PIN F UTILITY	27264	03-09-2022
J9	1251-2418	2	CONTACT-CONN FEM CRP .093-CONT-SZ	27264	02-09-1118
J10	1251-2510		CONNECTOR 2-PIN F UTILITY	27264	03-09-2022
J10	1251-2418		CONTACT-CONN FEM CRP .093-CONT-SZ	27264	02-09-1118
LF1	9100-0531	1	FILTER, AC LINE	28480	9100-0531
OE1	5060-0329	1	ENCODER, OPTICAL	28480	5060-0329
P1			NOT ASSIGNED		
P8			NOT ASSIGNED		
P9	1251-2505	2	CONNECTOR 2-PIN M UTILITY	27264	03-09-1022
P9	1251-2097	2	CONTACT-CONN MALE CRP .093-CONT-SZ	27264	02-09-2118
P10	1251-2505		CONNECTOR 2-PIN M UTILITY	27264	03-09-1022
P10	1251-2097		CONTACT-CONN MALE CRP .093-CONT-SZ	27264	02-09-2118
R1	2100-0666	1	RESISTOR, VAR CARBON 10K OHM 2% 1/2W	10582	EF9660
S1	3101-2074	2	SWITCH-TGL SUBMIN SPDT NS 2A 250VAC	28480	3101-2074
S2	3101-2074		SWITCH-TGL SUBMIN SPDT NS 2A 250VAC	28480	3101-2074
S3	3101-1694	1	SWITCH-TGL SUBMIN DPDT NS 2A 250VAC	09353	U318-PHI
T1	9100-3846	1	TRANSFORMER, POWER	28480	9100-3846
U1	1826-0181	1	IC LM 323 V PGLTR	27014	LM323K
U2	1826-0117	1	IC 7812C V RGLTR	07263	7812KC
U3	1826-0123	1	IC LM 320 V RGLTR	27014	LM320K-12
U4	1826-0122	1	IC 7805C V RGLTR	07263	7805UC
W1	04942-60054	1	CABLE ASSEMBLY, RIBBON, 20-COND	28480	04942-60054
W2	04942-60051	1	CABLE ASSEMBLY, COAX, 12 IN	28480	04942-60051
W3	04942-60050	1	CABLE ASSEMBLY, COAX, 9 IN	28480	04942-60050
W4	04942-60053	1	CABLE ASSEMBLY, RIBBON, 26-COND(OPT 010)	28480	04942-60053
W5	04942-60052	1	CABLE ASSEMBLY, RIBBON, 14-COND, 4 IN	28480	04942-60052
W6	04942-60055	1	CABLE ASSEMBLY, POWER SWITCH	28480	04942-60055
W7	8120-2220	1	POWER CORD, 3-COND, (USA)	28480	8120-2220
A1A2P2	1251-3277	2	CONNECTOR 4-PIN F POST TYPE	27264	09-50-7041
A1A2P2	1251-3073		CONTACT-CONN FEM CRP	27264	08-50-0107
A3P1	1251-3201	2	CONNECTOR 3-PIN F POST TYPE	27264	09-50-7031
A3P1	1251-3073		CONTACT-CONN FEM CRP	27264	08-50-0107
A3P3	1251-3277		CONNECTOR 4-PIN F POST TYPE	27264	09-50-7041
A3P3	1251-3073		CONTACT-CONN FEM CRP	27264	08-50-0107
A3P5	1251-3278	1	CONNECTOR 8-PIN F POST TYPE	27264	09-50-7081
A3P5	1251-3073		CONTACT-CONN FEM CRP	27264	08-50-0107
A5P3	1251-3613	1	CONNECTOR 2-PIN F POST TYPE	27264	09-50-7021
A5P3	1251-3073		CONTACT-CONN FEM CRP	27264	08-50-0107
A5P4	1251-3201		CONNECTOR 3-PIN F POST TYPE	27264	09-50-7031
A5P4	1251-3073		CONTACT-CONN FEM CRP	27264	08-50-0107
A6P1	1251-2993	1	CONNECTOR 6-PIN F POST TYPE	27264	09-50-3061
A6P1	1251-3073	7	CONTACT-CONN FEM CRP	27264	08-50-0107

Table 6-3. Replaceable Parts (30 of 38)

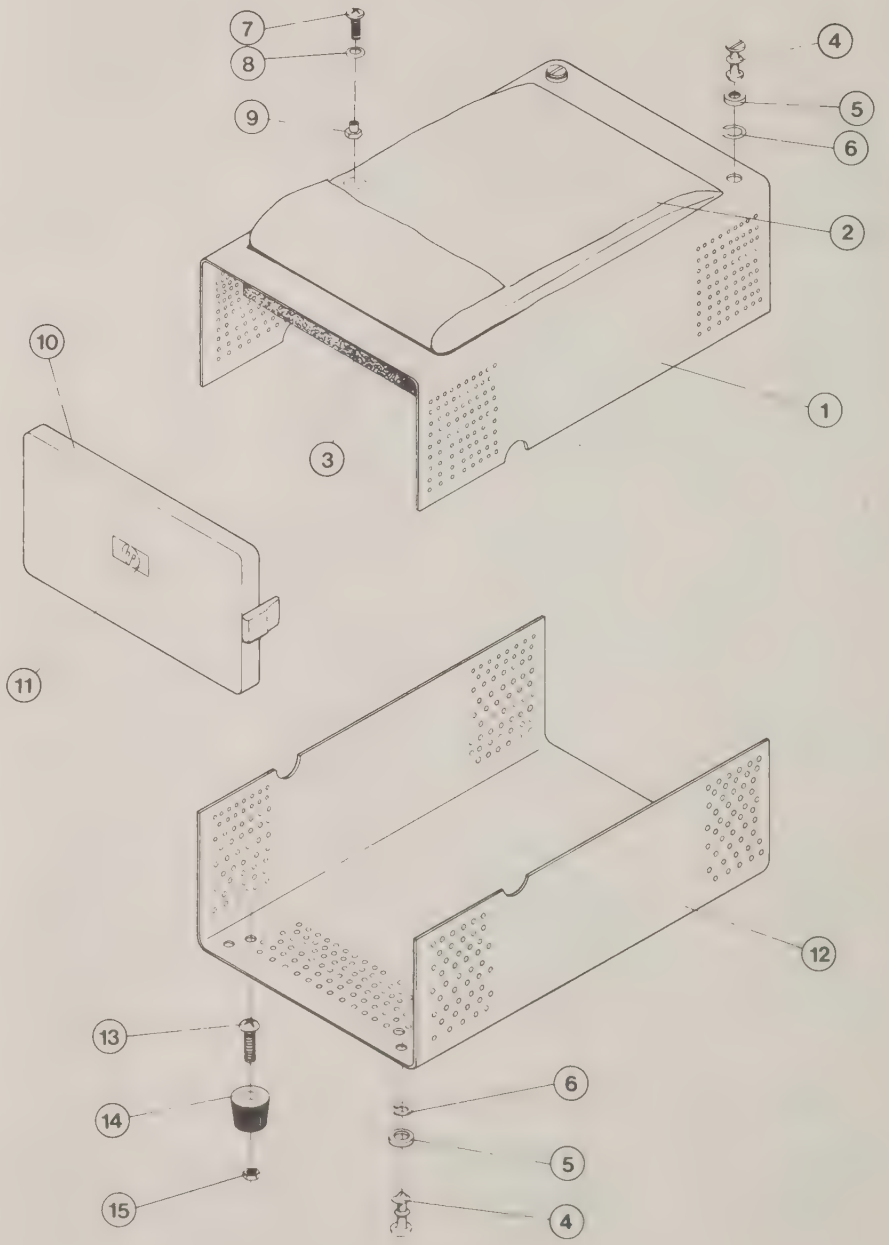


Table 6-3. Replaceable Parts (31 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			INSTRUMENT COVERS		
1	04942-00007	1	ASSEMBLY, TOP COVER (INCLUDES ITEMS 2 THRU 9, PLUS VINYL CLAD COVER)	28480	04942-00007
2	1540-0292	1	CASE-ACCESS PVC 13.5LG 10.5WD 2.5DP	28480	1540-0292
3	4208-0139	2	PAD, FOAM	28480	4208-0139
4	1390-0214	8	FASTENER-1/4-TURN STUD PANEL THKNS	28480	1390-0214
5	1390-0071	8	FASTENER-1/4-TURN WR WSHR .25 ID, .42	94222	82-46-101-41
6	1390-0257	8	FASTENER-1/4-TURN RTNR .22 ID, .36 OD	28480	1390-0257
7	2360-0197	4	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	28480	2360-0197
8	3050-0227	4	WASHER-FL MTLC NO.-6 .149-IN-ID	80120	AN960C-6
9	0510-0001	4	THREADED INSERT-NUT 6-32 .062-LG	28480	0510-0001
10	5040-0516	1	COVER, FRONT	28480	5040-0516
11	7120-4184	1	PLATE, ID	28480	7120-4184
12	04942-00008	1	ASSEMBLY, BOTTOM COVER (INCLUDES ITEMS 4 THRU 6, 13 THRU 15, AND VINYL COVER)	28480	04942-00008
13	2510-0107	4	SCREW-MACH 8-32 .5-IN-LG PAN-HD-POZI	28480	2510-0107
14	0403-0176	4	FOOT:BUMPER, RUBBER 0.938" DIA	98159	R-19
15	2580-0003	4	NUT-HEX-W/LKWR 8-32-THD .125-THK	28480	2580-0006

Table 6-3. Replaceable Parts (32 of 38)

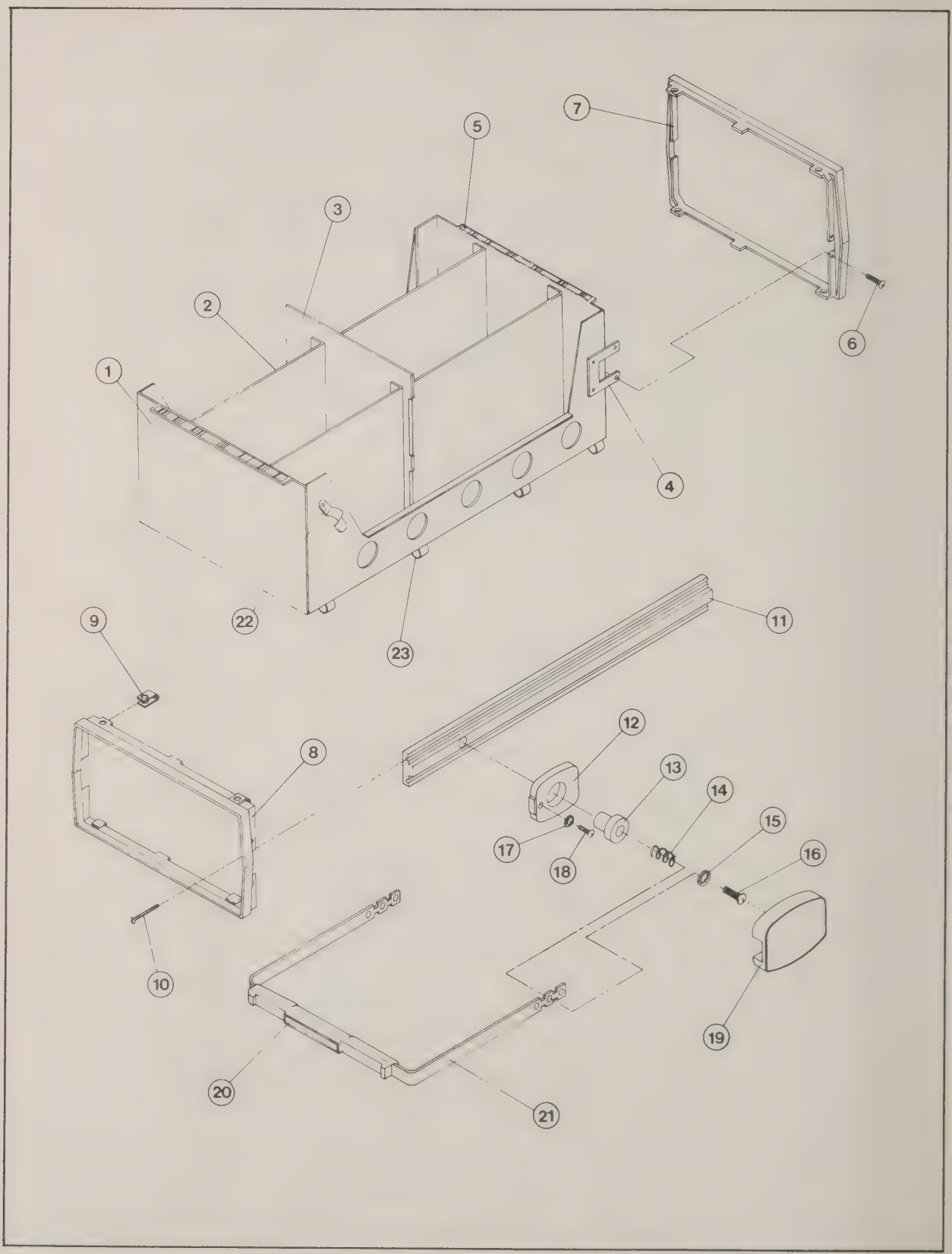
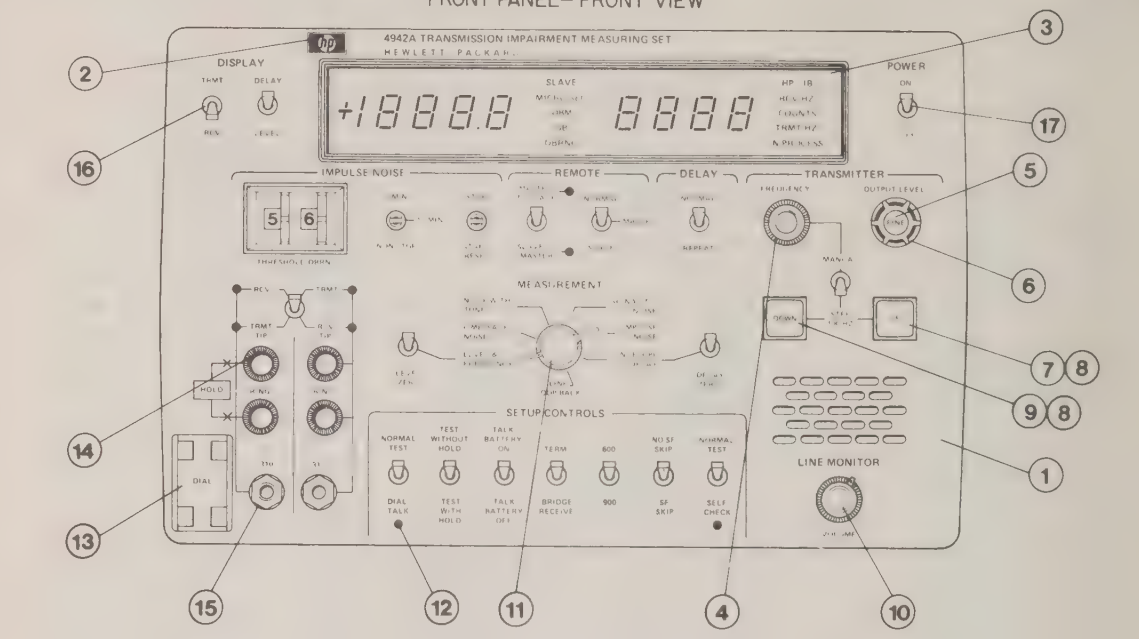


Table 6-3. Replaceable Parts (33 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			CHASSIS PARTS		
1	04942-00030	1	CARD CAGE	28480	04942-00030
2	04942-00005	4	SHIELD, CARD CAGE	28480	04942-00005
3	04942-00002	2	SEPARATOR, CARD CAGE	28480	04942-00002
4	04942-00015	2	BRACKET, MOUNTING	28480	04942-00015
5	7120-5548	2	LABEL SET, COLOR CODE	28480	7120-5548
6	2360-0115		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	28480	2360-0115
7	04942-20026	1	CASTING, REAR PANEL	28480	04942-20026
8	04942-20027	1	CASTING, FRONT PANEL	28480	04942-20027
9	1390-0091	8	FASTENER-1/4-TURN RCPT PANEL THKNS	94222	82-47-104-15
10	0624-0279	8	SCREW-TPG 8-32 .75-IN-LG PAN-HD-POZI	28480	0624-0279
11	01720-23701	2	RAIL, SIDE	28480	01720-23701
12	5020-8734	2	GEAR, RING	28480	5020-8734
13	5020-8733	2	GEAR	28480	5020-8733
14	1460-0604	2	SPRING-CPRSN .95-OD 1.185-LG MUW	28480	1460-0604
15	2190-0010	2	WASHER-LK EXT T NO.-8 .168-IN-ID	0G791	2-820-8C
16	2510-0113	2	SCREW-MACH 8-32 .875-IN-LG PAN-HD-POZI	28480	2510-0113
17	2190-0007		WASHER-LK INTL T NO.-6 .141-IN-ID	78189	1906-00
18	2360-0201	4	SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	28480	2360-0201
19	5040-0511	2	CAP, TRIM	28480	5040-0511
20	7120-5547	1	LABEL, HP LOGO	28480	7120-5547
21	5040-0515	1	HANDLE	28480	5040-0515
22	1400-0617	2	CLIP-TENSION 0.38-IN RND CAPACITY	06915	30-1
23	1400-0024	4	CLAMP-CA .25-DIA .5-WD NYL	71616	CPC 1953-4A
			MISCELLANEOUS		
	2200-0103	8	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	28480	2200-0103
	2200-0105	4	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	28480	2200-0105
	2360-0195	10	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	28480	2360-0195
	2360-0115	8	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	28480	2360-0115
	2510-0103	4	SCREW, MACH, PH, 8-32 X 3/8"	28480	2510-0103
	2260-0012	12	NUT-HEX-W/LKWR 4-40-THD .094-THK .25-A/F	28480	2260-0012
	0590-0680	14	THREADED INSERT-NUT 6-32 .13-LG STL	28480	0590-0680
	3050-0227	4	WASHER-FL MTLC NO.-6 .149-IN-ID	80120	AN960C-6
	2190-0007	14	WASHER-LK INTL T NO.-6 .141-IN-ID	78189	1906-00

Table 6-3. Replaceable Parts (34 of 38)



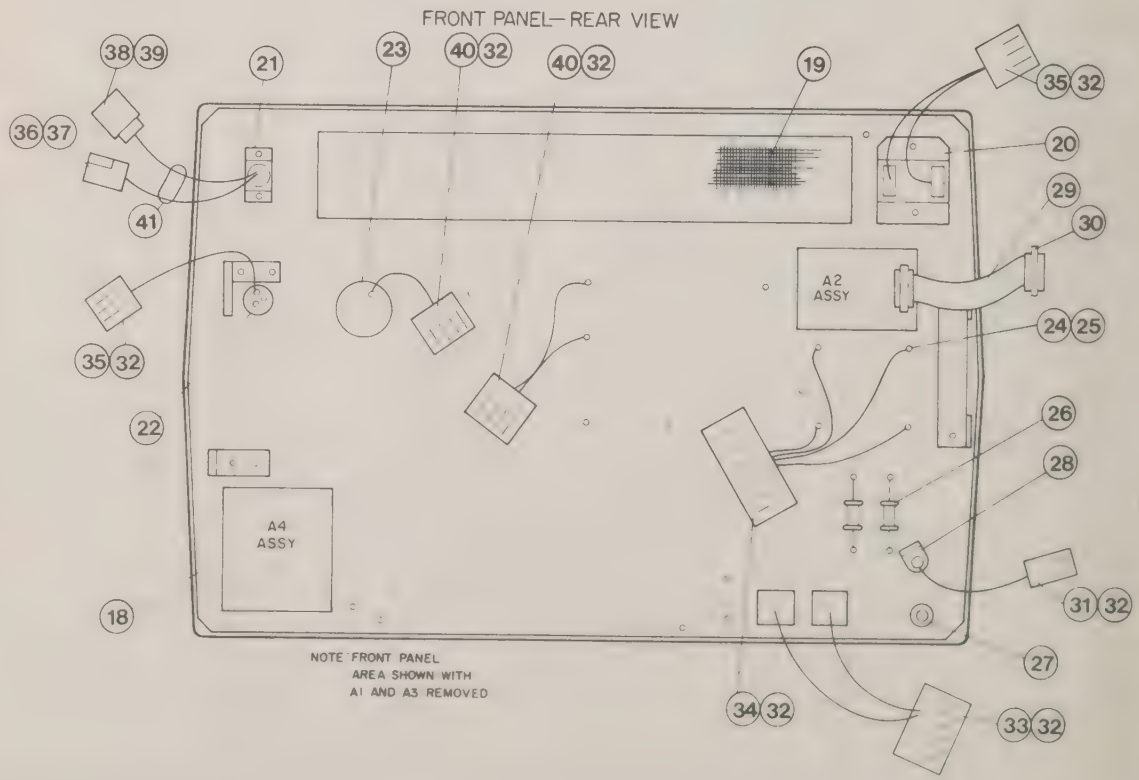
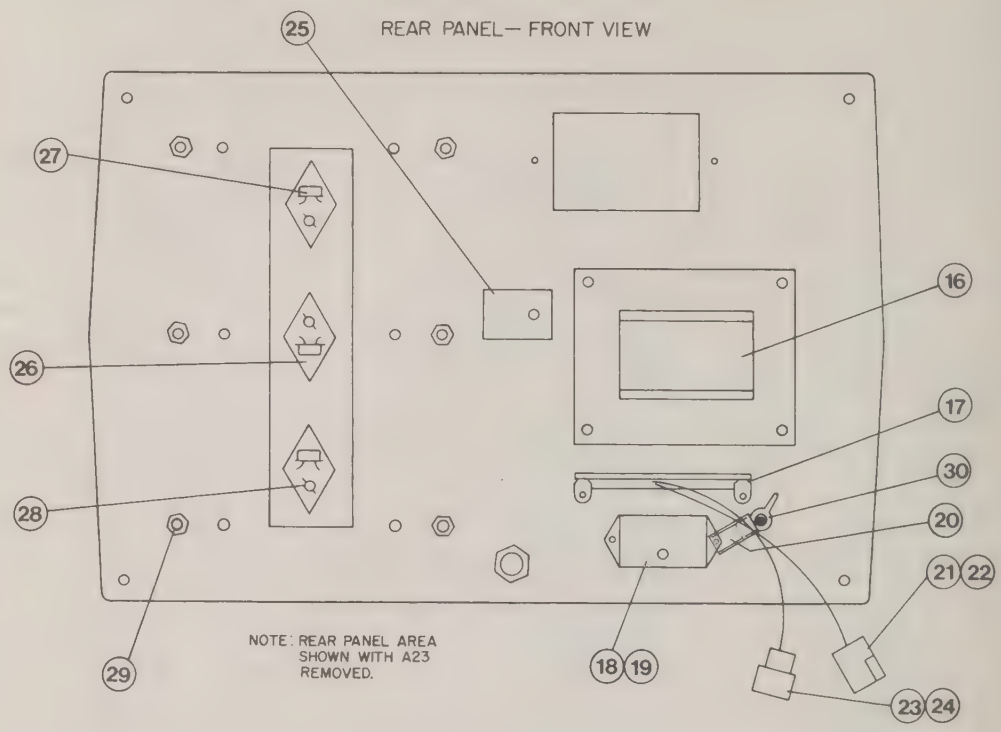


Table 6-3. Replaceable Parts (35 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			FRONT PANEL AREA		
1	04942-00003	1	PANEL, FRONT	28480	04942-00003
2	7120-1254	1	NAMEPLATE .312-IN-WD .54-IN-LG AL	28480	7120-1254
3	4040-1059	1	BEZEL, DISPLAY	28480	4040-1059
4	0370-1091	1	KNOB – ROUND	28480	0370-1091
5	0370-0963	1	KNOB – FINE	28480	0370-0963
6	0370-0667	1	KNOB, RIBBED, COARSE	28480	0370-0667
7	5041-0039	1	CAP, PUSHBUTTON, UP	28480	5041-0039
8	5040-6885	2	EXTENDER, PUSHBUTTON SWITCH	28480	5040-6885
9	5041-0038	1	CAP, PUSHBUTTON, DOWN	28480	5041-0038
10	0370-1099	1	KNOB – POINTER	28480	0370-1099
11	0370-1105	1	KNOB – LEVER	28480	0370-1105
12	1450-0513	8	LIGHT-IND LENS CAP RED TL LENS	28480	1450-0513
13	5060-7452	1	CONNECTOR, 2-CONT, DIAL (J1)	28480	5060-7452
14	1510-0090	4	CONNECTOR, BIND POST (J3, J4, J6, J7)	28480	1510-0090
15	1251-3677	2	CONNECTOR, 310 TYPE (J5, J8)	28480	1251-3677
16	3101-2074	2	SWITCH TOGGLE (S1, S2)	28480	3101-2074
17	3101-1694	1	SWITCH, TOGGLE, DPDT (S3)	09353	U318-PHI
18	04942-00004	1	PANEL, SUB(INCLUDES PRESS-IN STUDS & STANDOFFS)	28480	04942-00004
19	04942-00018	1	SHIELD, RFI, DISPLAY	28480	04942-00018
20	04942-00013	1	BRACKET, DISPLAY SWITCH	28480	04942-00013
21	04942-00012	1	BRACKET, POWER SWITCH	28480	04942-00012
22	2100-0666	1	POTENTIOMETER, 10K OHM (R1)	10582	EF9660
23	5060-0329	1	ENCODER, OPTICAL (OE1)	28480	5060-0329
24	1990-0442	6	DIODE – LED (CR1-CR6)	28480	1990-0442
25	4040-0706	6	BASE, LENS (XCR1 - XCR6)	28480	4040-0706
26	1970-0050	2	TUBE ELCTRN B1-A230 SURGE V PICTR (DS1, DS2)	3M768	B1-A230
27	0340-0732	2	INSULATOR-BDG POST POLYC (FOR J1)	28480	0340-0732
28	1400-0024	1	CLAMP-CA .25-DIA .5-WD NYL	71616	CPC 1953-44
29	04942-60052	1	CABLE, RIBBON 14-COND (W5)	28480	04942-60052
30	1200-0617	2	CLIP, RAIL (FOR W5)	28480	1200-0617
31	1251-3613	1	CONNECTOR 2-PIN F POST TYPE (A5P3)	27264	09-50-7021
32	1251-3073	30	CONTACT-CONN FEM CRP	27264	08-50-0107
33	1251-2993	1	CONNECTOR 6-PIN F POST TYPE (A6P1)	27264	09-50-3061
34	1251-3278	1	CONNECTOR 8-PIN F POST TYPE (A3P5)	27264	09-50-7081
35	1251-3201	2	CONNECTOR 3-PIN F POST TYPE (A3P1, A5P4)	27264	09-50-7031
36	1251-2510	1	CONNECTOR 2-PIN F UTILITY (J10)	27264	03-09-2022
37	1251-2418	2	CONTACT-CONN FEM CRP .093-CONT-SZ	27264	02-09-1118
38	1251-2505	1	CONNECTOR 2-PIN M UTILITY (P9)	27264	03-09-1022
39	1251-2097	2	CONTACT-CONN MALE CRP .093-CONT-SZ	27264	02-09-2118
40	1251-3277	2	CONNECTOR 4-PIN F POST TYPE (A1A2P2, A3P3)	27264	09-50-7041
41	04942-60055	1	ASSEMBLY, CABLE, POWER SWITCH (W6) (INCLUDES NO'S 17, 21, 36, 37, 38, 39 AND ASSOCIATED WIRE)	28480	04942-60055
			MISCELLANEOUS		
	8120-0202	39 IN.	CABLE-SHLD 2-COND 22-AWG	16428	8451
	0520-0164	4	SCREW-MACH 2-56 .25-IN-LG 82 DEG	28480	0520-0164
	2200-0113	10	SCREW, MACH, 4-40, .625-IN-LG, W/LCK	28480	2200-0113
	2200-0115	6	SCREW, MACH, 4-40, .75-IN-LG, W/LCK	28480	2200-0115
	0610-0002	4	NUT-HEX-DBL-CHAM 2-56-THD .062-THK	28480	0610-0002
	2420-0015	7	NUT-HEX-W/LKWR 6-32-THD .094-THK .25-A/F	28480	2420-0015
	2950-0001	8	NUT-HEX-DBL-CHAM 3/8-32-THD .094-THK	28480	2950-0030
	2190-0014	4	WASHER-LK INTL T NO.-2 .089-IN-ID	78189	1902-00
	3050-0227	3	WASHER-FL MTLC NO.-6 .149-IN-ID	80120	AN960C-6
	3050-0304	2	WASHER-FL MTLC NO.-5/16 .375-IN-ID	28480	3050-0304
	3050-0067	2	WASHER-FL MTLC NO.-5/16 .375-IN-ID	73734	31550
	2190-0016	6	WASHER-LK INTL T NO.-3/8 .377-IN-ID	28480	2190-0016

Table 6-3. Replaceable Parts (36 of 38)



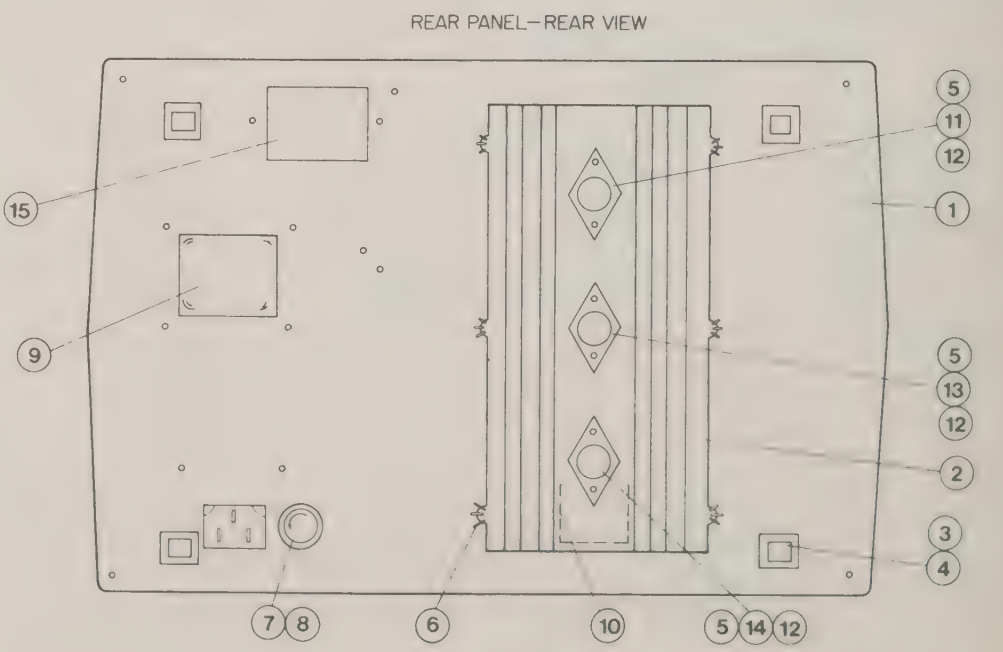


Table 6-3. Replaceable Parts (37 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			REAR PANEL AREA		
1	04942-00020	1	PANEL, REAR	28480	04942-00020
2	1205-0299	1	HEAT SINK, FINNED	28480	1205-0299
3	5040-5861	4	BASE, FOOT	28480	5040-5861
4	5040-5862	4	CAP, FOOT	28480	5040-5862
5	0340-0833	3	CAP, INSULATING, TO-3	28480	0340-0833
6	0340-0832	6	INSULATOR NYLON	28480	0340-0832
7	2110-0063	1	FUSE .75A 250V FAST-BLO 1.25X.25 UL IEC (F1)	75915	312.750
8	2110-0481	1	FUSEHOLDER-EXTR POST 15A 250V UL	28480	1400-0084
9	01710-04103	1	COVER, TRANSFORMER	28480	01710-04103
10	0905-0687	1	GASKET, FOAM	28480	0905-0687
11	1826-0123	1	IC LM 320 V RGLTR (U3)	27014	LM320K-12
12	0340-0417	3	INSULATOR-XSTR TO-3 .002-THK	13103	43-03-3
13	1826-0117	1	IC 7812C V RGLTR (U2)	07263	7812KC
14	1826-0181	1	IC LM 323 V RGLTR (U1)	27014	LM323K
15	04942-00032	1	PLATE, COVER	28480	04942-00032
16	9100-3846	1	TRANSFORMER, POWER (T1)	28480	9100-3846
17	0360-1123	1	TERMINAL STRIP 6-TERM PHEN 2.25-IN-L	83330	854
18	9100-0531	1	FILTER-LINE CEE-TERMS (LF1)	28480	9100-0531
19	5950-3816	1	LABEL, HI VOLT	28480	5950-3816
20	1400-0024	1	CLAMP-CA .25-DIA .5-WD NYL	71616	CPC 1953-4A
21	1251-2510	1	CONNECTOR 2-PIN F UTILITY (J9)	27264	03-09-2022
22	1251-2418	2	CONTACT-CONN FEM CRP .093-CONT-SZ	27264	02-09-1118
23	1251-2505	1	CONNECTOR 2-PIN M UTILITY (P10)	27264	03-09-1022
24	1251-2097	2	CONTACT-CONN MALE CRP .093-CONT-SZ	27264	02-09-2118
25	1826-0122	1	IC 7805C V RGLTR (U4)	07263	7805UC
26	1200-0536	3	SOCKET-XSTR 3-CONT TO-3-PKG	28480	1200-0536
27	0160-0174	3	CAPACITOR-FXD .47UF +80-20% 25WVDC CER (C1 3)	28480	0160-0174
28	1901-0696	3	DIODE-PWR RECT 400V 2A 200NS (CR7-CR9)	28480	1901-0696
29	0380-0093	6	STANDOFF-HEX .5LG 6-32THD .25A/F BRS	81150	R870-E
30	0360-0001	1	TERMINAL-LUG-SLDR 6 SCR .141/.086 ID	78452	920
			MISCELLANEOUS		
	0570-0920	1	STUD,PRESS-IN 6-32 X .312" LG, SST	46384	FHS-632-5
	0624-0213	3	SCREW-TPG 6-32 .5-IN-LG 82 DEG	28480	0624-0213
	2200-0105	2	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	28480	2200-0105
	2200-0143	2	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	28480	2200-0143
	2200-0091	1	SCREW-MACH 4-40 .562-IN-LG PAN-HD-POZI	28480	2200-0091
	2360-0195	10	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	28480	2360-0195
	2360-0201	6	SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	28480	2360-0201
	2360-0135	2	SCREW-MACH 6-32 1.5-IN-LG PAN-HD-POZI	28480	2360-0135
	2360-0302	2	SCREW-MACH 6-32 1.625-IN-LG PAN-HD-POZI	28480	2360-0302
	2510-0109	6	SCREW-MACH 8-32 .625-IN-LG PAN-HD-POZI	28480	2510-0109
	2680-0071	4	SCREW-MACH 10-32 1.75-IN-LG PAN-HD-POZI	28480	2680-0071
	2260-0012	3	NUT-HEX-W/LKWR 4-40-THD .094-THK .25-A/F	28480	2260-0012
	2420-0015	1	NUT-HEX-W/LKWR 6-32-THD .094-THK .25-A/F	28480	2420-0015
	2740-0006	4	NUT-HEX-W/LKWR 10-32-THD .125-THK	28480	2740-0006
	2190-0416	1	WASHER-FL MTLC NO.-4 .125-IN-ID	28480	2190-0416
	3050-0227	4	WASHER-FL MTLC NO.-6 .149-IN-ID	80120	AN960C-6
	2190-0046	6	WASHER-LK HLCL NO.-6 .141-IN-ID	28480	2190-0046
	2190-0007	12	WASHER-LK INTL T NO.-6 .141-IN-ID	78189	1906-00
	2190-0010	6	WASHER-LK EXT T NO.-8 .168-IN-ID	0G791	2-820-BC
	2190-0054	1	WASHER-LK INTL T NO.-1/2 .505-IN-ID	78189	1924-12

Table 6-3. Replaceable Parts (38 of 38)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			REAR PANEL AREA WITH HP-IB(OPT 010)		
1	04942-00027	1	PLATE, COVER, HP-IB	28480	04942-00027
2	04942-60024	1	PC BOARD ASSEMBLY, INCLUDES 24-CONT FEMALE CONNECTOR AND SMALL PC BOARD	28480	04942-60024
3	0380-0643	2	STANDOFF, LG STUD MOUNT(METRIC THREAD)	00464	OBD#
4	04942-60053	1	CABLE ASSEMBLY, RIBBON, 26-COND(W4)	28480	04942-60053
			MISCELLANEOUS		
	2420-0015	2	NUT-HEX-W/LKWR 6-32-THD .094-THK .25-A/F	28480	2420-0015
Not Shown	7120-5911	1	LABEL, METRIC THD WARNING	28480	7120-5911

REAR PANEL AREA
WITH HP-IB (OPT-010)

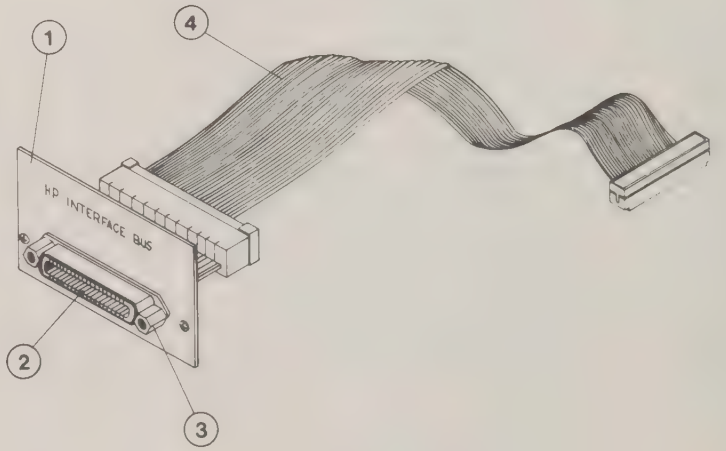


Table 6-4. Code List of Manufacturers (1 of 2)

MFR. NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
0G791	Thompson Bremer Div. Vare.	Chicago, IL	60622
0007K	Kabelmetal		
0016E	Exar Integrated Systems Inc.	Sunnyvale, CA	94086
0046A	Adac Screw Machine Products		
00779	Amp Inc.	Harrisburg, PA	17105
0083S	S.E.I. Mfg	Northridge, CA	91324
01121	Allen-Bradley Co.	Milwaukee, WI	53212
01295	Texas Instr. Inc. Semicond. Cmpnt. Div.	Dallas, TX	75231
02735	RCA Corp. Solid State Div.	Sommerville, NJ	08876
03508	G.E. Co. Semiconductor Prod. Dept.	Syracuse, NY	13201
03888	KDI Pyrofilm Corp.	Whippany, NJ	07981
03911	Clairex Corp.	Mt. Vernon, NY	10550
04713	Motorola Semiconductor Products	Phoenix, AZ	85008
06776	Robinson Nugent Inc.	New Albany, IN	47150
06915	Richeo Plastic Co.	Chicago, IL	60646
07263	Fairchild Semiconductor Div.	Mountain View, CA	94040
07933	Raytheon Co. Semiconductor Div. Hq.	Mountain View, CA	94040
09353	C and K Components Inc.	Watertown, MA	02172
10582	CTS of Ashville Inc.	Skyland, NC	28776
11236	CTS of Berne Inc.	Berne, IN	46711
13103	Thermalloy Co.	Dallas, TX	75247
15818	Teledyne Semiconductor	Mountain View, CA	94040
16428	Belden Corp.	Richmond, IN	47374
17856	Siliconix Inc.	Santa Clara, CA	95050
18324	Signetics Corp.	Sunnyvale, CA	94086
19701	MEPCO/Electra Corp.	Mineral Wells, TX	76067
20940	Micro-Ohm Corp.	El Monte, CA	91731
24355	Analog Devices Inc.	Norwood, MA	02062
24546	Corning Glass Works (Bradford)	Bradford, PA	16701
27014	National Semiconductor Corp.	Santa Clara, CA	95051
27264	Molex Products Co.	Downers Grove, IL	60515
28480	Hewlett-Packard Co. Corporate Hq.	Palo Alto, CA	94304
3H768	Siemens Corp.	Iselin, NJ	08830
32997	Bourns Inc. Trimpot Prod. Div.	Riverside, CA	92507
46384	Penn Engineering & Mfg. Corp.	Doylestown, PA	18901
50088	Mostek Corp.	Carrollton, TX	75006
54294	Cutler-Hammer-Inc. Shallcross Mfg. Co.	Selma, NC	27576
56289	Sprague Electric Co.	North Adams, MA	01247
59730	Thomas & Betts Co. The	Elizabeth, NJ	07207
71279	Cambridge Thermionic Corp.	Cambridge, MA	02138
71468	ITT Cannon Electric Co.	Santa Ana, CA	92702
71616	Commercial Plastics Co.	Mundelein, IL	60060
71785	TRW Elek Components Cinch Div.	Elk Grove Village, IL	60007
72136	Electro Motive Corp. Sub. IEC	Willimantic, CT	06226
73734	Federal Screw Products Co.	Chicago, IL	60618
75915	Littelfuse Inc.	Des Plaines, IL	60016
76381	3M Company	St. Paul, MN	55101
78189	Illinois Tool Works Inc. Shakeproof	Elgin, IL	60126
78452	Everlock Chicago Inc.	Chicago, IL	60622

Table 6-4. Code List of Manufacturers (2 of 2)

MFR. NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
80120	Schnitzer Alloy Products Co.	Elizabeth, NJ	07206
81150	Cemco Mfg. Co.	Columbus, OH	43215
83330	Smith Herman H. Inc.	Brooklyn, NY	11207
84411	TRW Capacitor Div.	Ogallala, NE	69153
91506	Augat Inc.	Attleboro, MA	02703
91637	Dale Electronics Inc.	Columbus, NE	68601
94222	Southco Inc.	Lester, PA	19113
98159	Rubber Teck Inc.	Gardena, CA	90247
98291	Sealectro Corp.	Mamaroneck, NY	10544
99779	Barnes Div. Bunker-Ramo Corp.	Lansdowne, PA	19050

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

7-2. This section provides information for making this manual applicable to earlier configurations of the Model 4942A. Enter the backdating information (or the change number, if more convenient) into the appropriate places in the manual.

INSTRUMENT CHANGES

INSTRUMENT SERIAL NUMBER	MAKE CHANGES
1624A-00120 and below	1
1624A-00175 and below	1 and 2

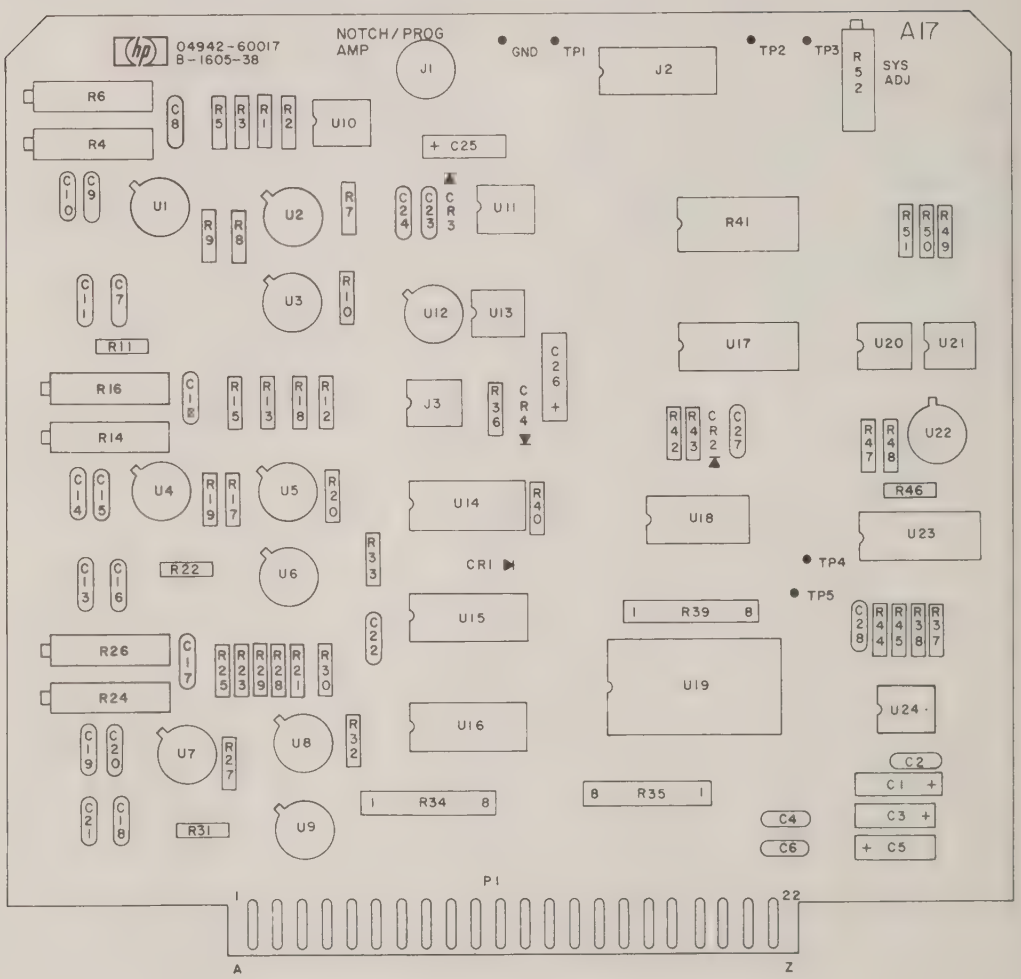
ASSEMBLY CHANGES

ASSEMBLY REF. DES.	DESCRIPTION	SERIES	MAKE CHANGES
A17	Notch Filt. & Prog. Amp.	1605	1
A19	Freq. Track. Loop	1605	2

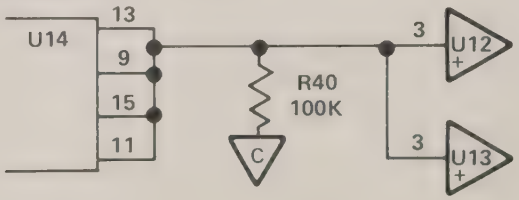
CHANGE NO. 1

Page 6-25, Table 6-3 (21 of 38):
Delete A17U25 and A17R53.
Change A17R41 to HP P/N 1810-0262, same value.

Page 8-64, Figure 8-50.
Disregard component locator and use the one below.



Page 8-65, Figure 8-51:
Delete U25 and R53
Make electrical connection as shown below.



CHANGE NO. 2

Page 6-27, Table 6-3 (23 of 38):
Change A19C16 and A19C18 to HP P/N 0160-2221, 1300 PF.

Page 6-29, Table 6-3 (25 of 38):
Change A19U6 to HP P/N 1820-1356, MC14528CP.

Page 8-68, Figure 8-55:
Change series code of PC board to B-1605-38.

Page 8-69, Figure 8-56:
Change value of C16 and C18 to 1300 PF.
Change series code of schematic to 1605.

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SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. This section contains service information for the Model 4942A Transmission Impairment Measuring Set. Included are troubleshooting hints, troubleshooting techniques, mechanical access, and theory of operation.

8-3. MAINTENANCE PRECAUTIONS

8-4. The following precautions should be taken to insure against serviceperson injury and instrument damage:

a. Remove ac power from the instrument when hooking up test equipment or test fixtures, when removing/installing instrument covers, when removing/installing PC boards or any other suspected malfunctioning component.

b. Use a properly grounded 3-wire receptacle for the instrument's power cord.

WARNING

Voltages at ac line potential are present at several points. Use extreme caution when making measurements or replacing PC boards or components.

c. Plan and think through your repair actions before you perform them.

8-5. AFTER SERVICE PRODUCT SAFETY CHECKS

8-6. Visually inspect interior of instrument for any signs of abnormal internally generated heat, such as discolored printed circuit boards or components, damaged insulation, or evidence of arcing. Determine and remedy cause of any such condition.

8-7. Using a suitable ohmmeter, check resistance from instrument enclosure to ground pin on power cord plug. The reading must be less than one ohm. Flex the power cord while making this measurement to determine whether intermittent discontinuities exist.

8-8. Check any indicated front or rear panel ground terminals marked, using the above procedures.

8-9. Check resistance from instrument enclosure to line and neutral (tied together) with the power switch on and the power source disconnected. The minimum acceptable resistance is two megohms. Replace any component which results in a failure.

8-10. Check line fuse(s) to verify that a correctly rated fuse is installed.

8-11. GENERAL TROUBLESHOOTING HINTS

8-12. To isolate a fault in the 4942A, a large amount of information can be obtained from the front panel. If a problem occurs, it is important to find answers to the following questions:

a. Does the instrument work properly in any measurement? If so, which ones?

b. Can the problem be isolated to only the transmit mode — only the receive mode?

c. Can the problem be isolated to only the normal mode — only the self-check mode — only the master-slave mode?

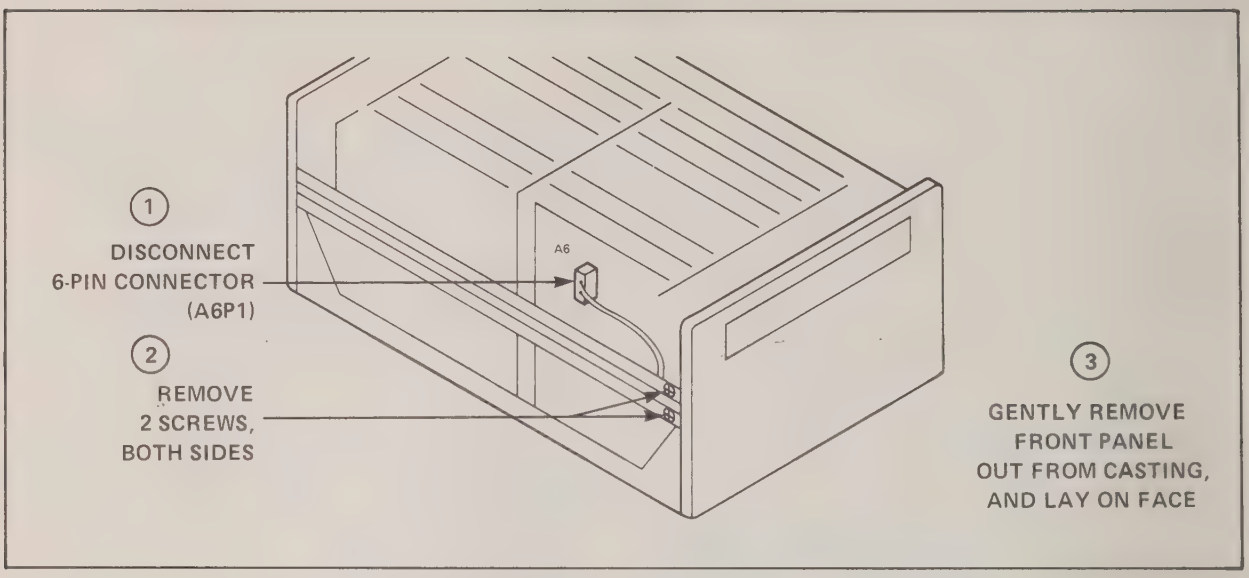


Figure 8-1. Front Panel Area Access

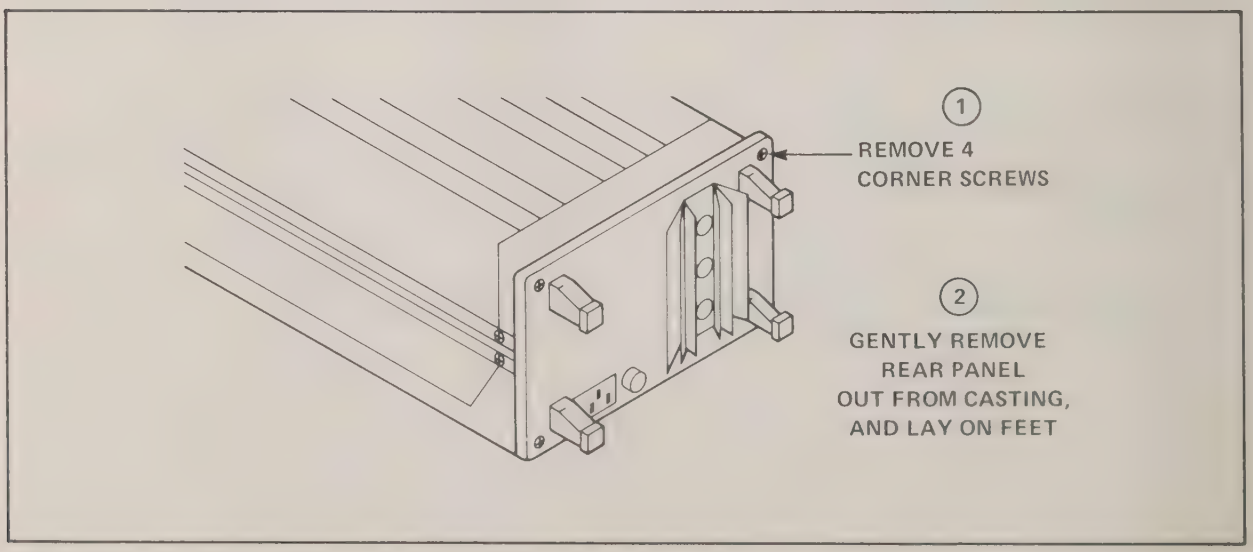


Figure 8-2. Rear Panel Area Access

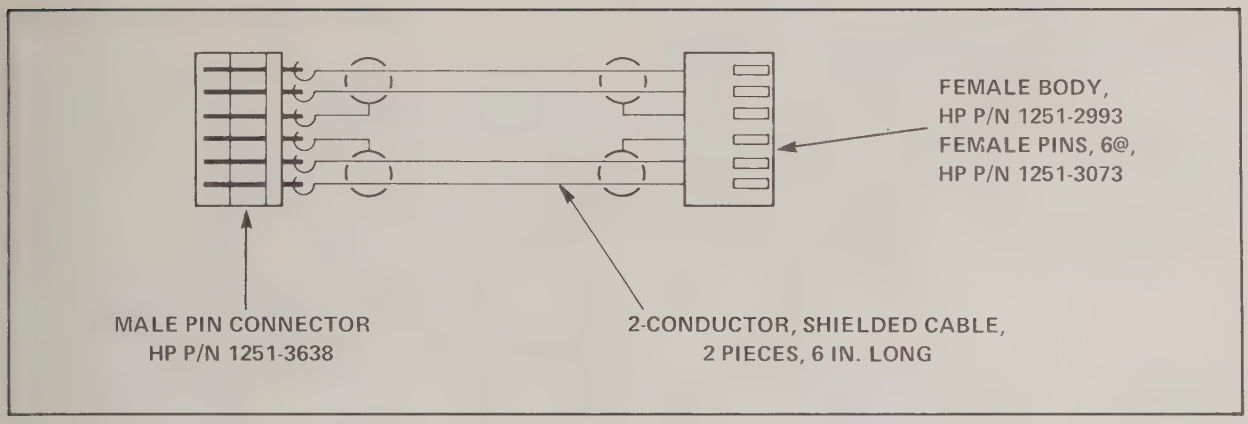


Figure 8-3. Test Lead Extension, Front Panel

8-13. MECHANICAL ACCESS AND DISASSEMBLY

8-14. Either top or bottom cover may be removed by turning their four twist-lock connectors 1/4 turn counterclockwise. Removing the top cover gives access to all plug-in PC board assemblies. Removing the bottom cover gives access to the connector pins of all the PC board assemblies. Pin numbers are labeled for test convenience.

8-15. Figure 8-1 shows how to gain access to the front panel area. Note that one connector must be disconnected before removing the front panel. The instrument may then be operated with the front panel removed from its mount and lying face down. However, since the disconnected cable is too short, the test lead extender in Figure 8-3 is needed. Improved operation will result if a ground wire jumper is added from front panel metal to chassis metal.

8-16. The rear panel area is accessible as shown in Figure 8-2. No test lead extenders are needed here, with the rear panel removed from its mount.

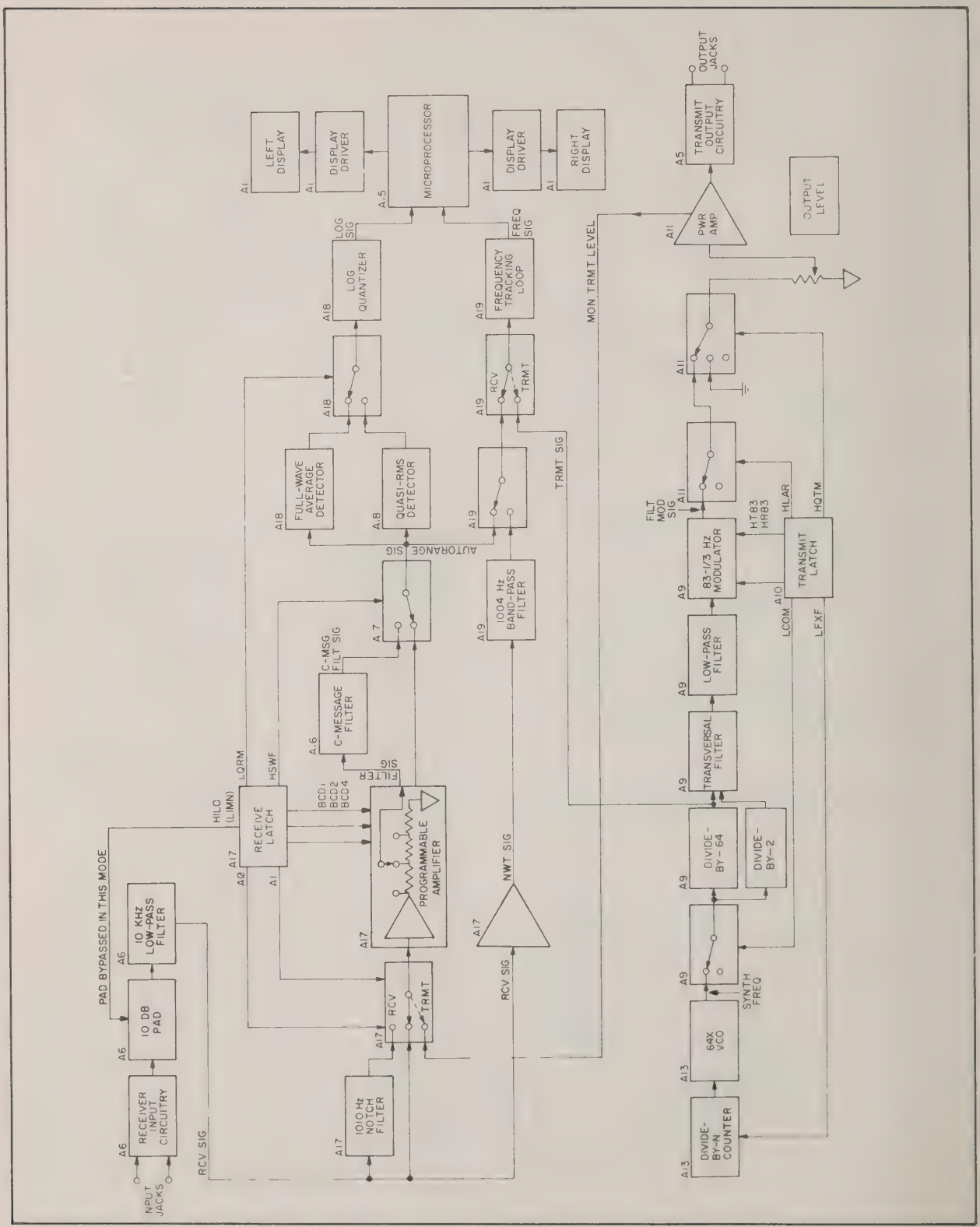


Figure 8-4. Level & Frequency Block Diagram

8-17. THEORY OF OPERATION

8-18. The following paragraphs describe the signal paths within the Model 4942A. A block diagram level discussion is used. No attempt is made to describe the principal of the measurement, since Section 3 of this manual covers that subject. The following description will therefore help the repair technician trace signals through the instrument. Each measurement is described; first the transmit function, then receive. At the end is a brief description of modem operation. The modem circuitry is used by the master and slave units to "talk" to each other.

8-19. LEVEL AND FREQUENCY, TRANSMIT MODE

8-20. The transmitter circuitry performs the function of a variable frequency, variable power sine wave oscillator. Figure 8-4 illustrates both transmit and receive functions.

8-21. At the lower left of the figure is the divide-by-N counter. This counter is an integral part of a phase locked loop for controlling the voltage controlled oscillator (VCO). The VCO operates at 64 times the eventual output frequency. The divide-by-N counter can be set up by either front panel control switches or the microprocessor. At turn-on, the processor sets the VCO to operate at 64,256 Hz (64 x 1004 Hz). The front panel controls may then be used to adjust the transmit frequency.

8-22. The VCO signal is divided by 2 and by 64 for application to the transversal filter. The transversal filter is in effect a digital filter for producing analog signals. Using a combination of properly timed digital pulses, the transversal filter produces a sine wave shaped waveform. The waveform contains discrete, intermediate steps. Since the discrete steps appear at 32 times the output frequency (the particular case of this circuit), they are easy to filter out using a low-pass filter. The transversal filter waveform appears opposite the A9 schematic in this manual.

8-23. The sine wave from the low-pass filter passes through the 83 Hz modulator (unmodulated) to the power amplifier on A11. This signal is transferred through impedance matching circuitry to the front panel TRMT-RCV jacks. The impedance matching circuitry also converts the unbalanced amplifier output to a balanced configuration.

8-24. The VCO frequency, divided by 64, is used to produce the actual transmit frequency for display purposes. This signal is routed to the frequency tracking loop. This circuitry contains a 32X VCO in a phase locked loop configuration. This 32 times multiplication in a controlled time constant loop gives a steady, flickerless frequency display. Circuitry, at the microprocessor, counts the frequency, divides by 32, and passes this data to the right display.

8-25. The power amplifier output signal on A11 is sampled to produce the output level display. The signal loops back around to the programmable amplifier for detection by the full-wave average detector. The detector output is converted to a pulse stream by the log quantizer. The log quantizer is in essence an A-to-D converter. A counter on the microprocessor assembly counts the pulses to measure the transmit level. The processor sends this information to the left display.

8-26. LEVEL AND FREQUENCY, RECEIVE MODE

8-27. The receiver circuitry performs the function of an average reading ac voltmeter. This circuitry is also shown in Figure 8-4. Both transmit and receive functions are shown here because of the shared circuitry.

8-28. The receiver input circuitry converts the balanced input signal to unbalanced with the proper impedance match. The 10 KHz low-pass filter removes any high frequency noise or other unwanted telephone circuit signaling noise. The received signal is then processed by the programmable amplifier, average detector, and log quantizer for level display. The received signal takes a parallel path from the programmable amplifier to the frequency tracking loop. This signal is used for frequency display.

8-29. The programmable amplifier has a 50 dB dynamic range (−40 dBm to +10 dBm in Level and Frequency). The amplifier's output is tapped (or sampled) in 10 dB steps, to keep the output within the range of the log quantizer. The programming instructions originate from the microprocessor according to the overrange or underrange condition of the log quantizer. So to produce a level display, the microprocessor considers the log quantizer output along with the selected 10 dB "window" of the programmable amplifier.

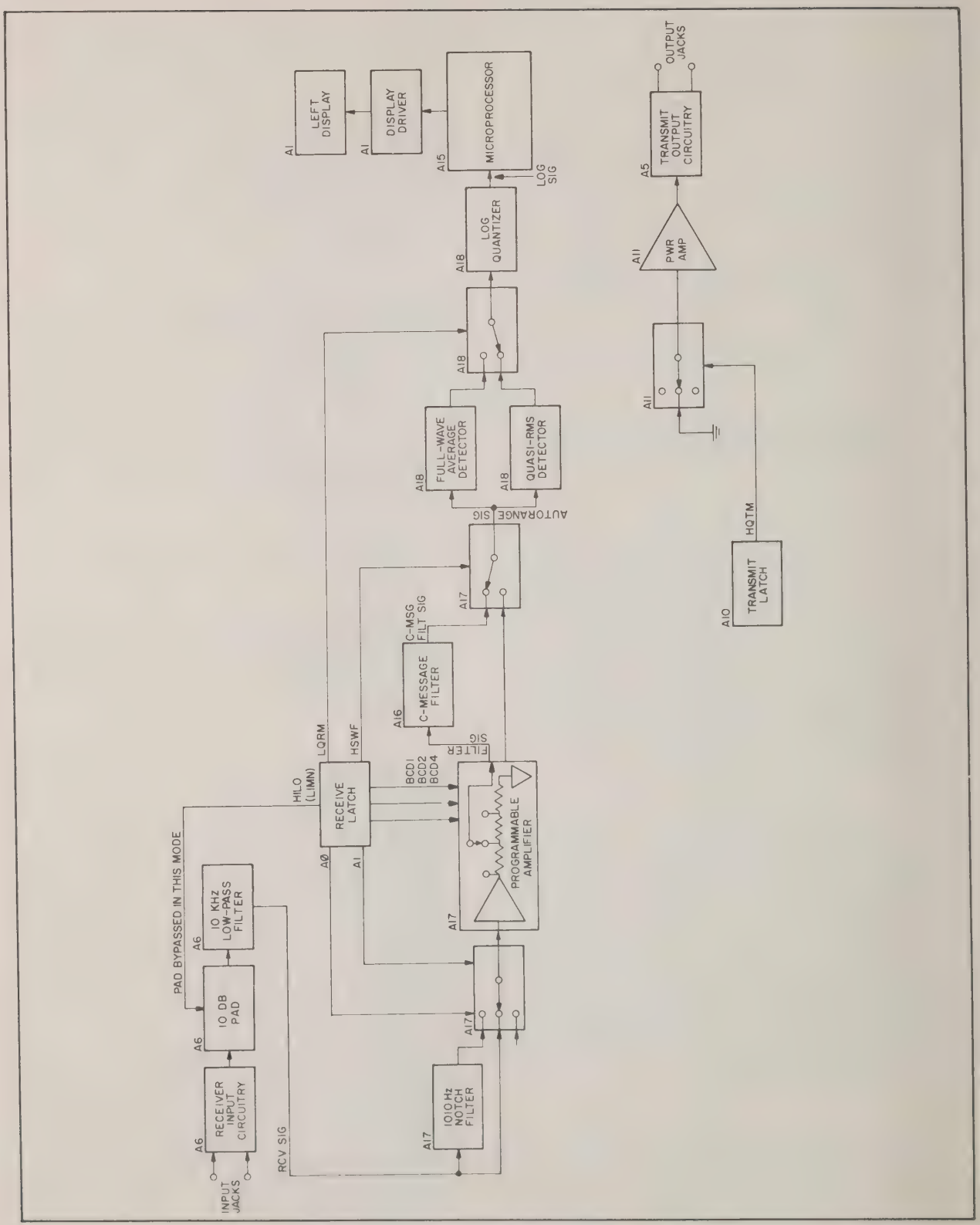


Figure 8-5. C-Message Noise Block Diagram

8-30. C-MESSAGE NOISE, TRANSMIT MODE

8-31. The transmitter functions as a quiet termination for its end of the telephone circuit. A quiet termination is a simple resistive circuit, with no signal applied.

8-32. C-MESSAGE NOISE, RECEIVE MODE

8-33. The receiver circuitry performs the function of a quasi-RMS ac voltmeter, with C-message filtering. Figure 8-5 illustrates the receive function.

8-34. The receive circuitry for this measurement is similar to Level and Frequency except: (1) There is no frequency display since there is no frequency to receive, (2) a different level detector is used, and (3) a frequency weighting is used (C-message). The quasi-RMS detector provides a detection response which closely approximates true RMS detection of the incoming noise signal.

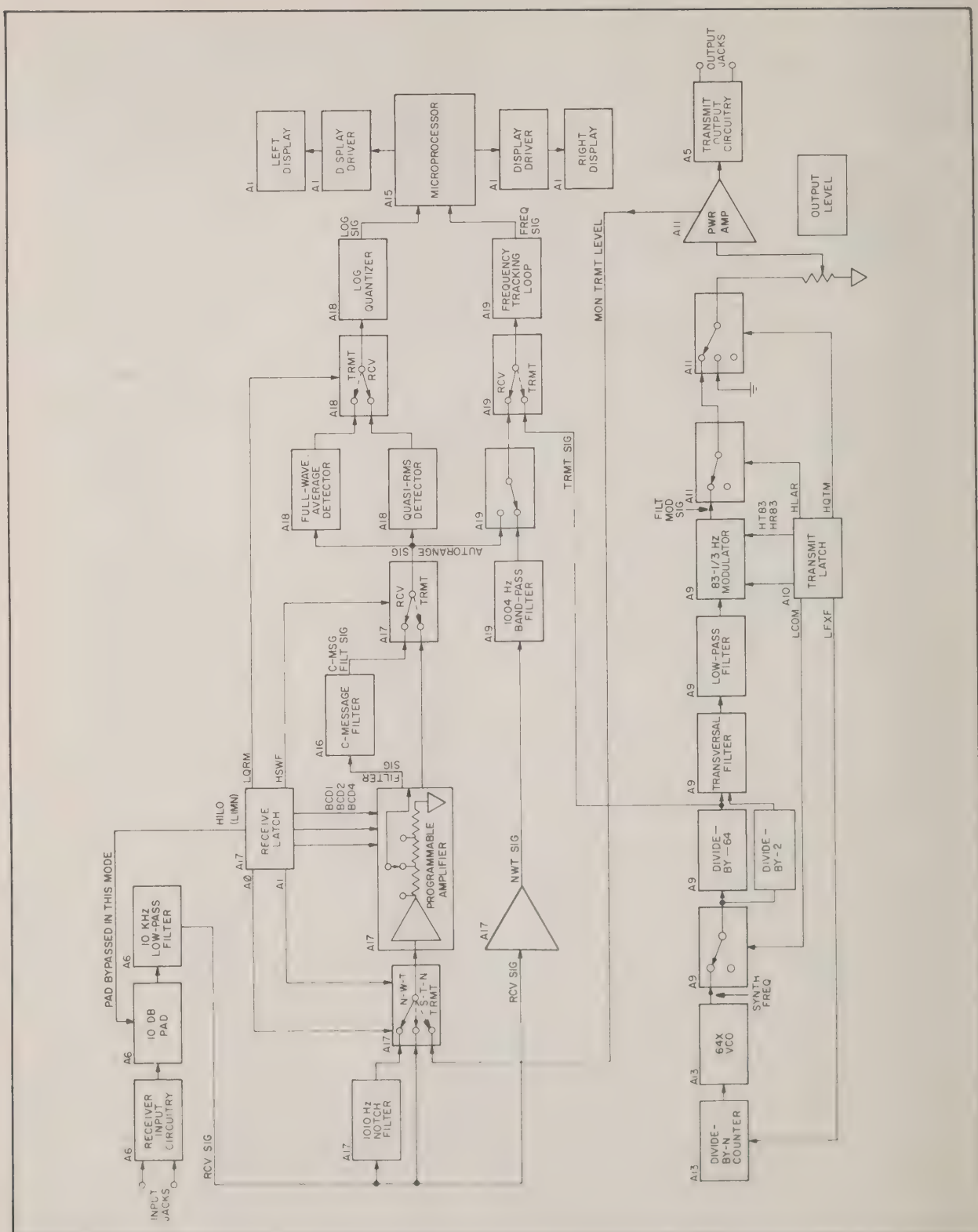


Figure 8-6. Noise-with-Tone and Signal-to-Noise Block Diagram

8-35. NOISE-WITH-TONE, TRANSMIT MODE

8-36. The transmitter circuitry functions as a fixed frequency, variable power sine wave oscillator. Figure 8-6 illustrates this measurement configuration.

8-37. The transmitter functions identically to the Level and Frequency transmitter with one exception: the transmit frequency is fixed at 1004 Hz.

8-38. NOISE-WITH-TONE, RECEIVE MODE

8-39. The receiver functions as a quasi-RMS ac voltmeter, with C-message filtering and a 1010 Hz notch filter.

8-40. The 1004 Hz signal transmitted at the far end of the circuit allows the measurement of noise with a tone present on the complete circuit. To measure just the noise at the receive end, the tone must be removed before detection of the noise level. The 1010 Hz notch filter does this. Although the center frequency of the notch filter is 6 Hz away from the test signal, the notch bandwidth allows adequate attenuation. All other received signal components (noise) pass through the filter for detection by the quasi-RMS detector.

8-41. To allow display of the received 1004 Hz frequency, the RCV SIG bypasses the programmable amplifier. The signal is buffered on A17 and goes to a 1004 Hz band-pass filter on A19. This signal may then be selected for application to the frequency tracking loop.

8-42. SIGNAL-TO-NOISE, TRANSMIT MODE

8-43. The transmitter circuitry functions as a fixed frequency, variable power sine wave oscillator. Figure 8-6 illustrates this measurement configuration. The transmitter is identical to the noise-with-tone mode with a fixed 1004 Hz signal.

8-44. SIGNAL-TO-NOISE, RECEIVE MODE

8-45. The receiver functions as a quasi-RMS ac voltmeter with C-message filtering. The 1010 Hz notch filter is alternately switched in and out to obtain two measurement readings: (1) combined level of the 1004 Hz tone with noise, and (2) noise only. The microprocessor then compares these two received levels to derive the signal-plus-noise to noise value.

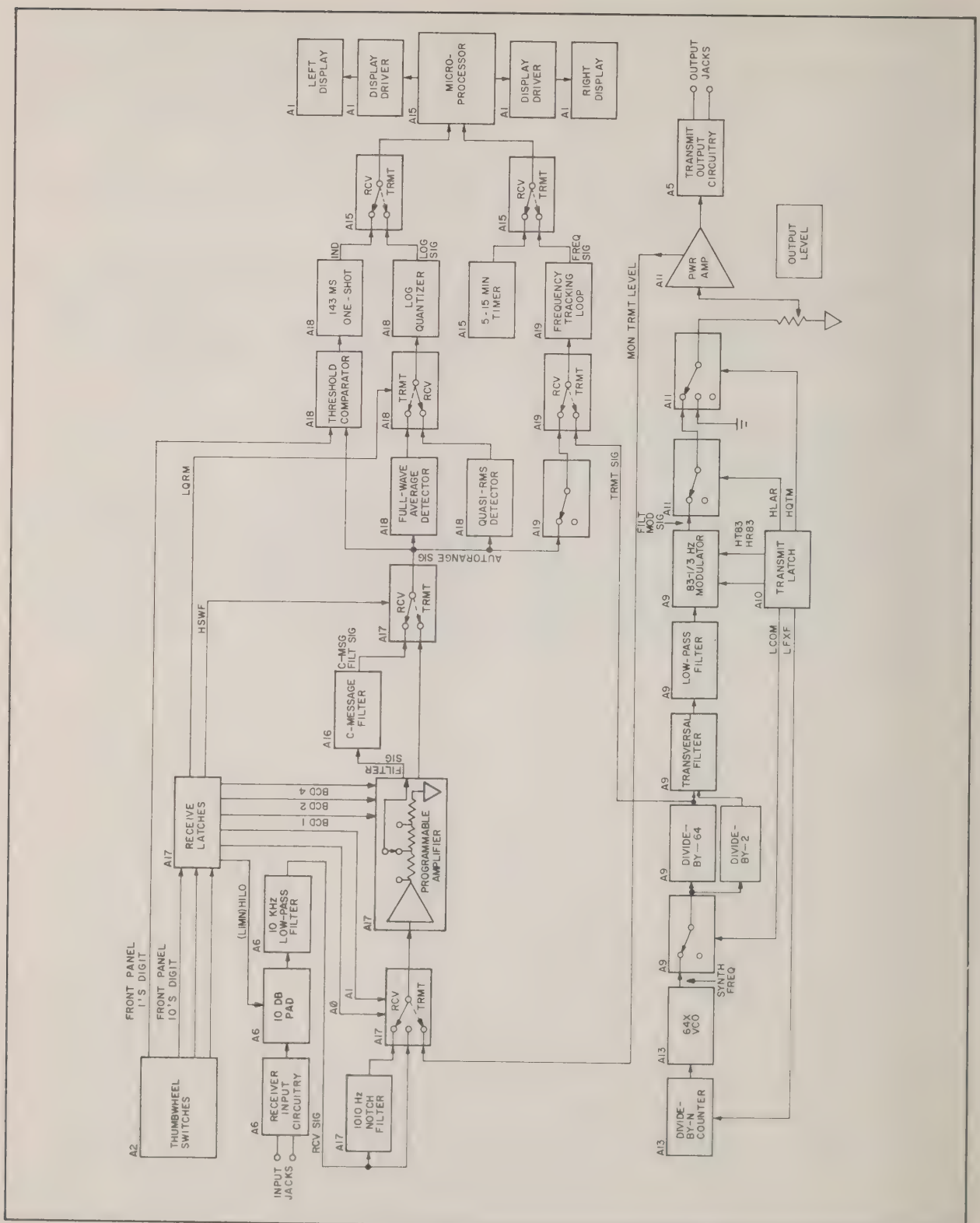


Figure 8-7. Impulse Noise Block Diagram

8-46. IMPULSE NOISE, TRANSMIT MODE

8-47. The transmitter functions as a fixed frequency (1004 Hz), variable power sine wave oscillator. Figure 8-7 illustrates this measurement configuration.

8-48. IMPULSE NOISE, RECEIVE MODE

8-49. The receiver functions as a transient noise spike totalizer, with threshold detection at a selectable level.

8-50. The received signal is attenuated by 10 dB on the A6 board (this is the only measurement using the 10 dB pad). The 1010 Hz notch filter removes the 1004 Hz tone from the incoming signal. The resultant signal (noise) is amplified by the programmable amplifier. The programmable amplifier does not autorange to a 10 dB window as in the Level and Frequency measurement. Instead, it performs a straight amplification (selectable in 10 dB steps) according to the setting of the IMPULSE NOISE thumbwheel switch (10's digit switch).

8-51. The programmable amplifier output signal is shaped by the C-message filter for application to the threshold comparator. The threshold detection level is set by the IMPULSE NOISE thumbwheel switch (units digit switch). So out of the comparator is a squared pulse train, following the rate of the detectable impulse noise spikes. This pulse train is applied to a 143 mS one-shot. This one-shot limits the maximum count rate to 7 per second. The pulses from the one-shot are sent to the microprocessor board for counting and display.

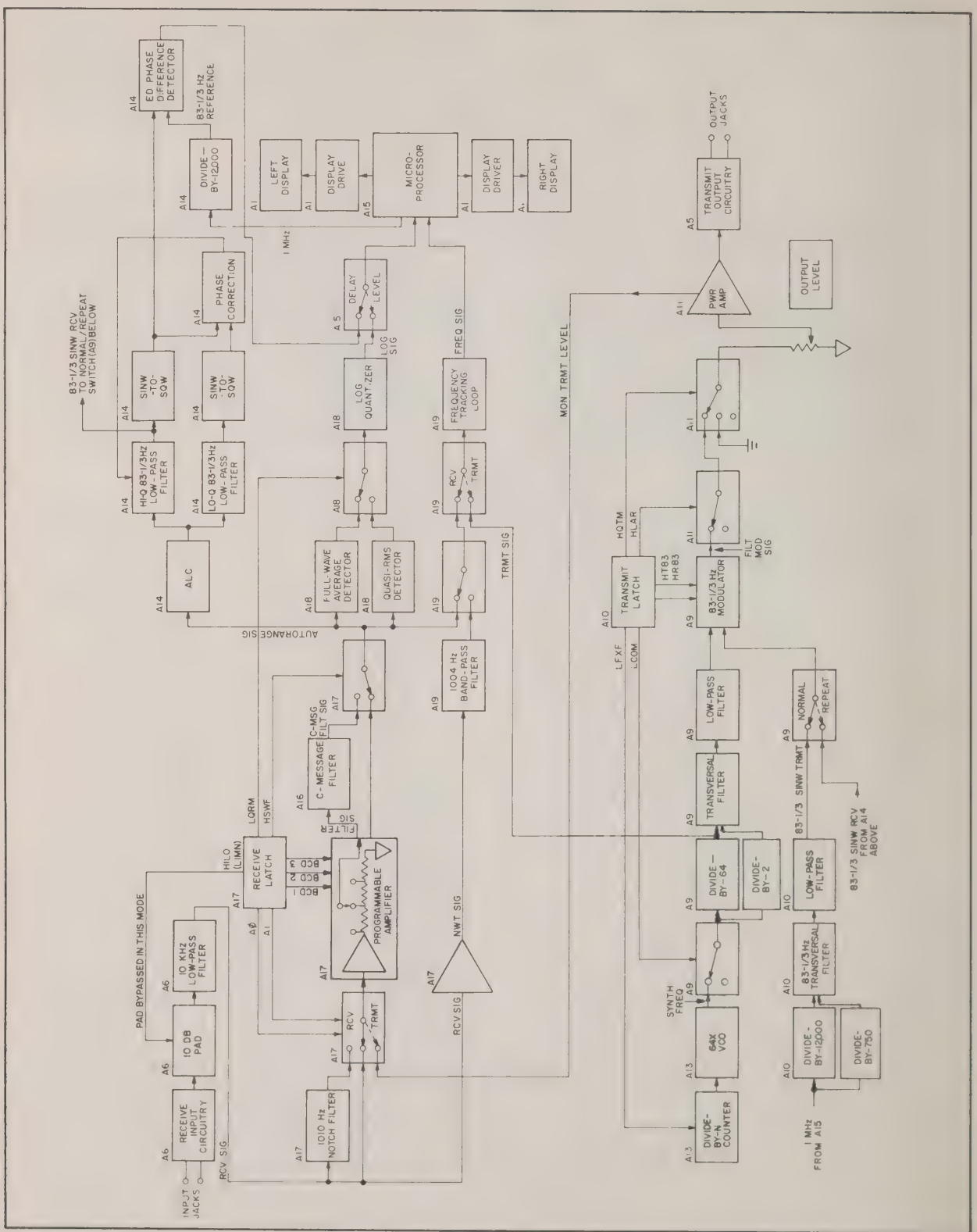


Figure 8-8. Envelope Delay Block Diagram

8-52. ENVELOPE DELAY, TRANSMIT MODE

8-53. The transmitter functions as a variable frequency, variable power AM (amplitude modulation) signal generator. The test signal produced is a variable carrier frequency (204 to 3904 Hz) with a fixed modulation frequency (83-1/3 Hz). Figure 8-8 illustrates this measurement.

8-54. The carrier frequency is derived in the same fashion as in the Level and Frequency measurement. This signal does, however, have 83-1/3 Hz amplitude modulation added at the A9 assembly. The 83-1/3 Hz signal originates from one of two sources, depending on whether the unit is operating in the normal or repeat mode.

8-55. If the normal mode is selected, the 83-1/3 Hz signal originates from the 1 MHz crystal controlled oscillator on the microprocessor assembly. The divide-by-12,000 and divide-by-750 circuitry produces the timing pulses for the 83-1/3 Hz transversal filter. A low-pass filter produces the proper sine-wave signal for application to the 83-1/3 Hz modulator.

8-56. If the repeat mode is selected, the 83-1/3 Hz signal is derived from the incoming received signal. The incoming signal comes through the input circuitry and programmable amplifier to the HI-Q 83-1/3 Hz low-pass filter. This filter selectivity passes the modulating signal for retransmission by the transmit circuitry.

8-57. ENVELOPE DELAY, RECEIVE MODE

8-58. The receiver functions as an AM demodulator and envelope delay comparator/calculator.

8-59. For received level display (at either the normal or repeat set), the full wave average detector is used. The log quantizer produces the pulse stream for application to the microprocessor assembly for counting.

8-60. For envelope delay detection and display at the normal set, a phase comparison is made. Both the received 83-1/3 Hz signal, and an internally generated 83-1/3 Hz reference, drive the envelope delay phase difference detector on the A14 assembly. This detector gates a 1 MHz clock. These gated pulse groups are then counted at the microprocessor assembly for envelope delay display.

8-61. The received signal at the output of the programmable amplifier goes to automatic level control circuitry on A14. This presents a normalized signal level to two different 83-1/3 Hz low-pass filters. The HI-Q filter is used to select the actual 83-1/3 Hz signal for envelope delay detection (normal set) or retransmission (repeat set). Since the HI-Q filter exhibits an unacceptable temperature characteristic (phase shift versus temperature), it needs compensation. The LO-Q filter exhibits less temperature dependency, and provides a reference signal for the HI-Q filter. This signal is used by the HI-Q filter to maintain a constant internal phase shift.

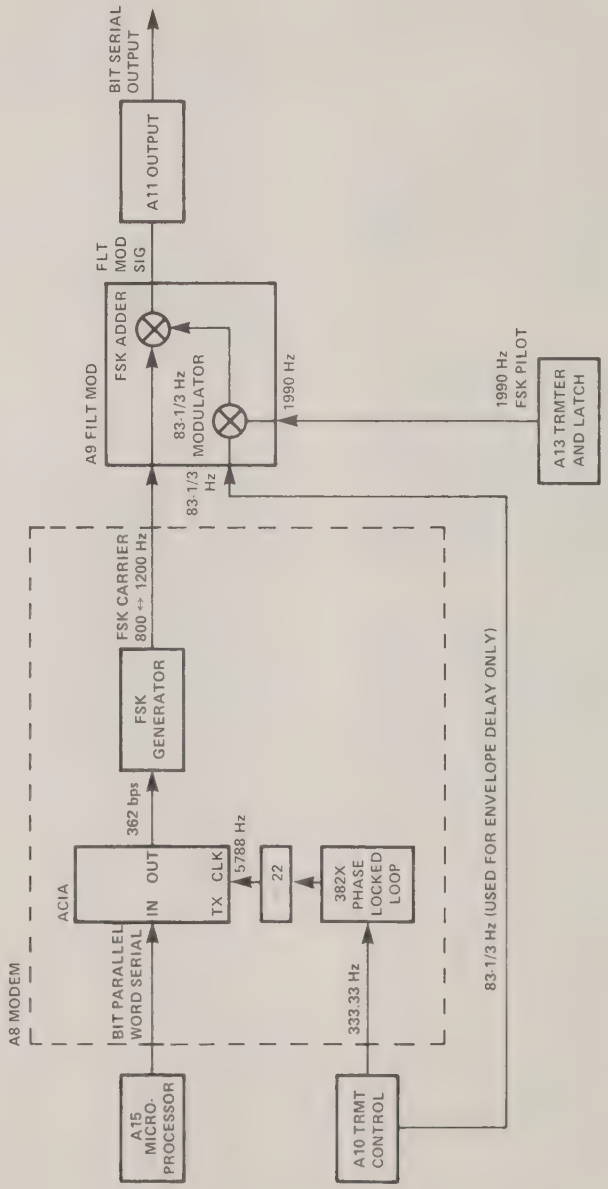


Figure 8-9. Modem Transmit Block Diagram

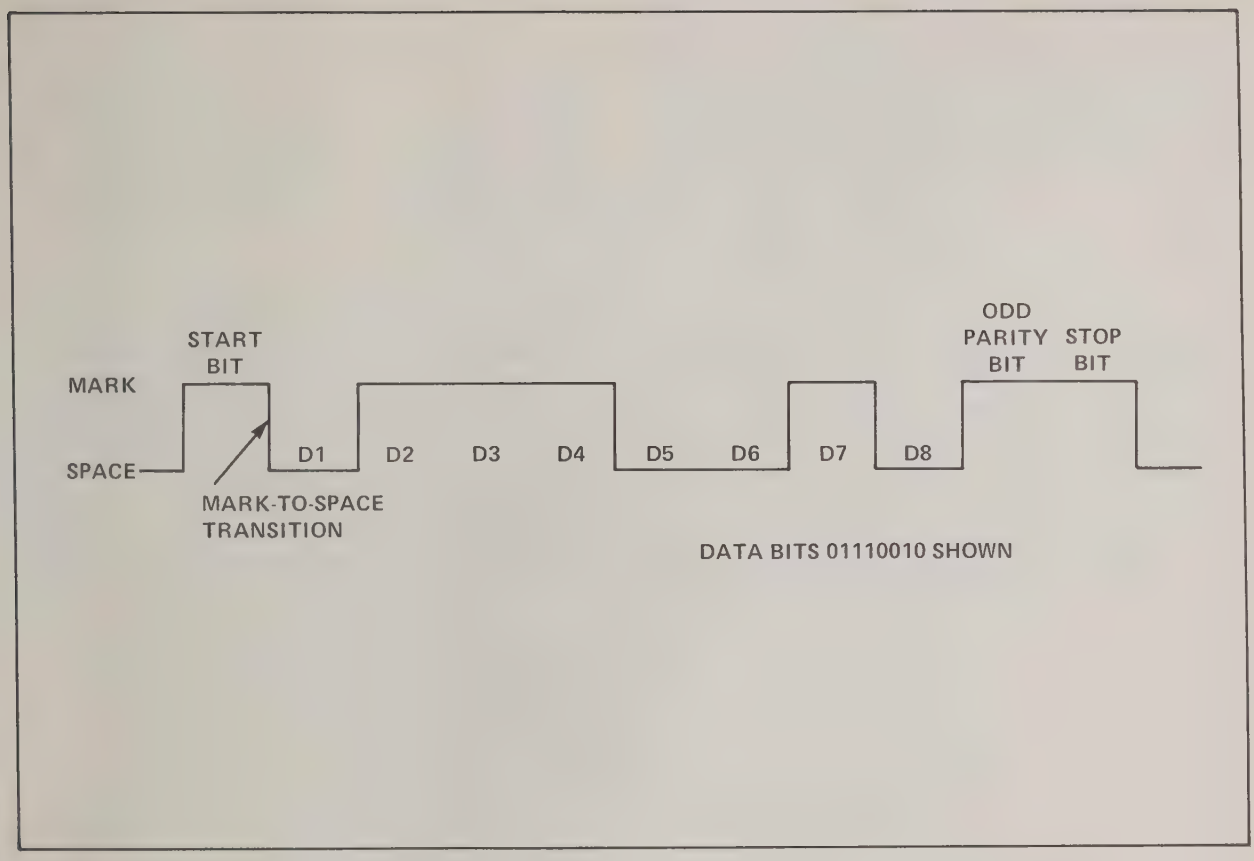


Figure 8-10. Modem Data Word

8-62. MODEM OPERATION, TRANSMIT

8-63. The modem circuitry enables communication between the widely separated master and slave units. This allows the master-slave function to operate. Communication takes place over a 4-wire telephone circuit. Figure 8-9 illustrates the modem transmit function.

8-64. The data to be transmitted is originated by the microprocessor assembly. The microprocessor transfers information to the modem over the 8-bit data bus in a bit parallel, word serial fashion. The ACIA device (asynchronous communications interface adapter) accepts the 8-bit parallel word. The ACIA outputs the 8-bits in serial fashion (one bit at a time) to the FSK generator. The FSK generator converts the input dc voltage levels to the shifting 800 Hz — 1200 Hz FSK carrier.

8-65. The ACIA formats the 8-bit word into an eleven bit serial word as shown in Figure 8-10. A mark-to-space transition "start bit" precedes the data word. An odd parity bit plus a mark stop bit are added at the end. These data bits are transmitted at a 362 baud rate (362 bps). To achieve this rate, the 5788 Hz transmit clock is divided by 16 inside the ACIA.

8-66. The FSK carrier is combined with a 1990 Hz signal (FSK pilot) during modem operation. The two signals are mixed at the filter modulator assembly before passing to the output board. The presence of the 1990 Hz pilot "alerts" the far end modem receive circuits that an FSK signal is being received.

8-67. While testing for envelope delay in the slave-to-master direction, the 1990 Hz signal also serves as the fixed frequency envelope delay carrier. This is a special case for the envelope delay measurement.

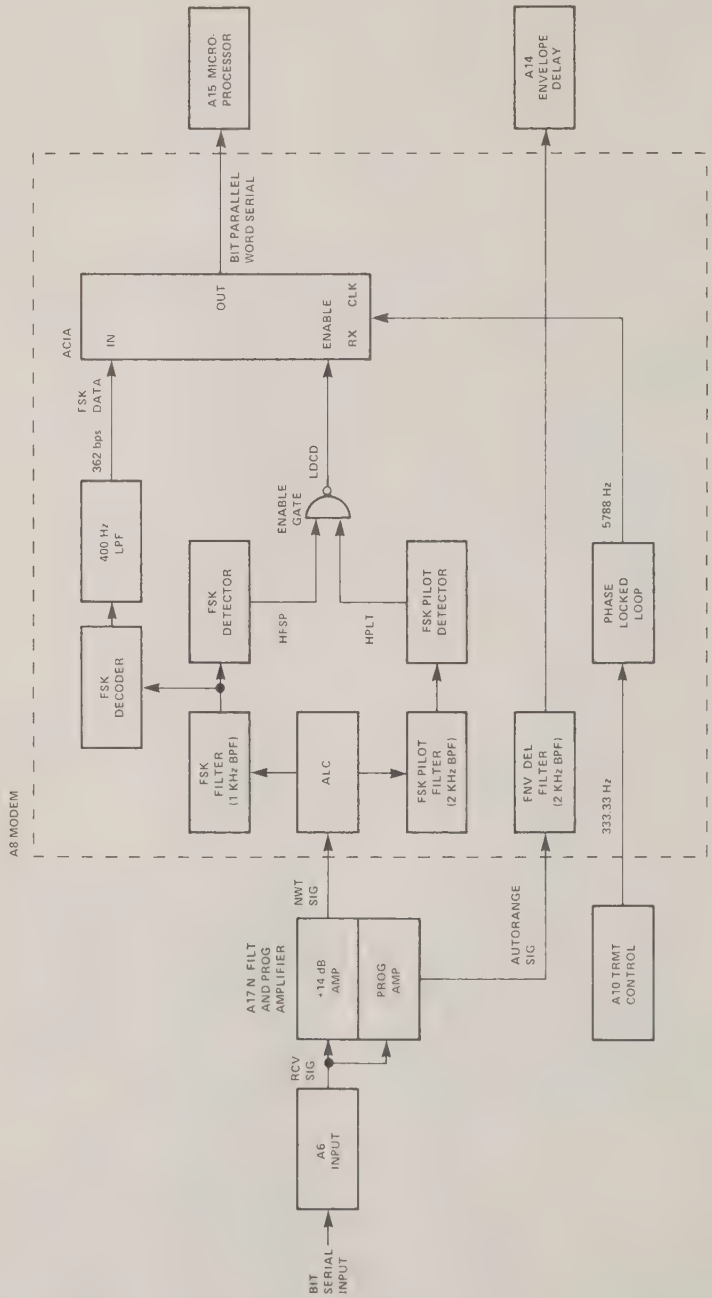


Figure 8-11. Modem Receive Block Diagram

8-68. MODEM OPERATION, RECEIVE

8-69. Figure 8-11 illustrates modem receive operation. The received signal arrives at the modem after receiving a fixed amplification at the A17 assembly. The modem automatic level control (ALC) circuit normalizes the received signal level. This normalized signal is passed to the FSK filter and the FSK pilot filter.

8-70. The FSK filter passes only the FSK signal (800 Hz and 1200 Hz) to the FSK detector. With an apparent FSK signal present, the enable gate has one input true. The FSK pilot filter passes only the 1990 Hz signal to the FSK pilot detector. With a 1990 Hz signal present, it is confirmed that FSK from the far end unit has arrived. The remaining input of the enable gate then goes true. The gate then produces the data carrier detect signal (LDCD) to "tell" the ACIA to begin accepting the incoming data.

8-71. The output of the FSK filter is also routed to the FSK decoder. This circuit converts the shifting FSK carrier to a string of data pulses. The 400 Hz low pass filter allows only the 362 baud signal to pass. The ACIA converts the incoming serial bits into 8-bit parallel words for the microprocessor.

8-72. During the special case of testing for envelope delay in the slave-to-master direction, the 1990 Hz signal is also routed to the envelope delay filter. This filter serves to pass the 1990 Hz signal with its AM modulation. The output of this filter is used for the actual envelope delay measurement. This extra filtering is needed to help separate out the 1990 Hz signal from the FSK signal. At the envelope delay board, the 83-1/3 Hz modulation is removed for transmission back to the master unit.

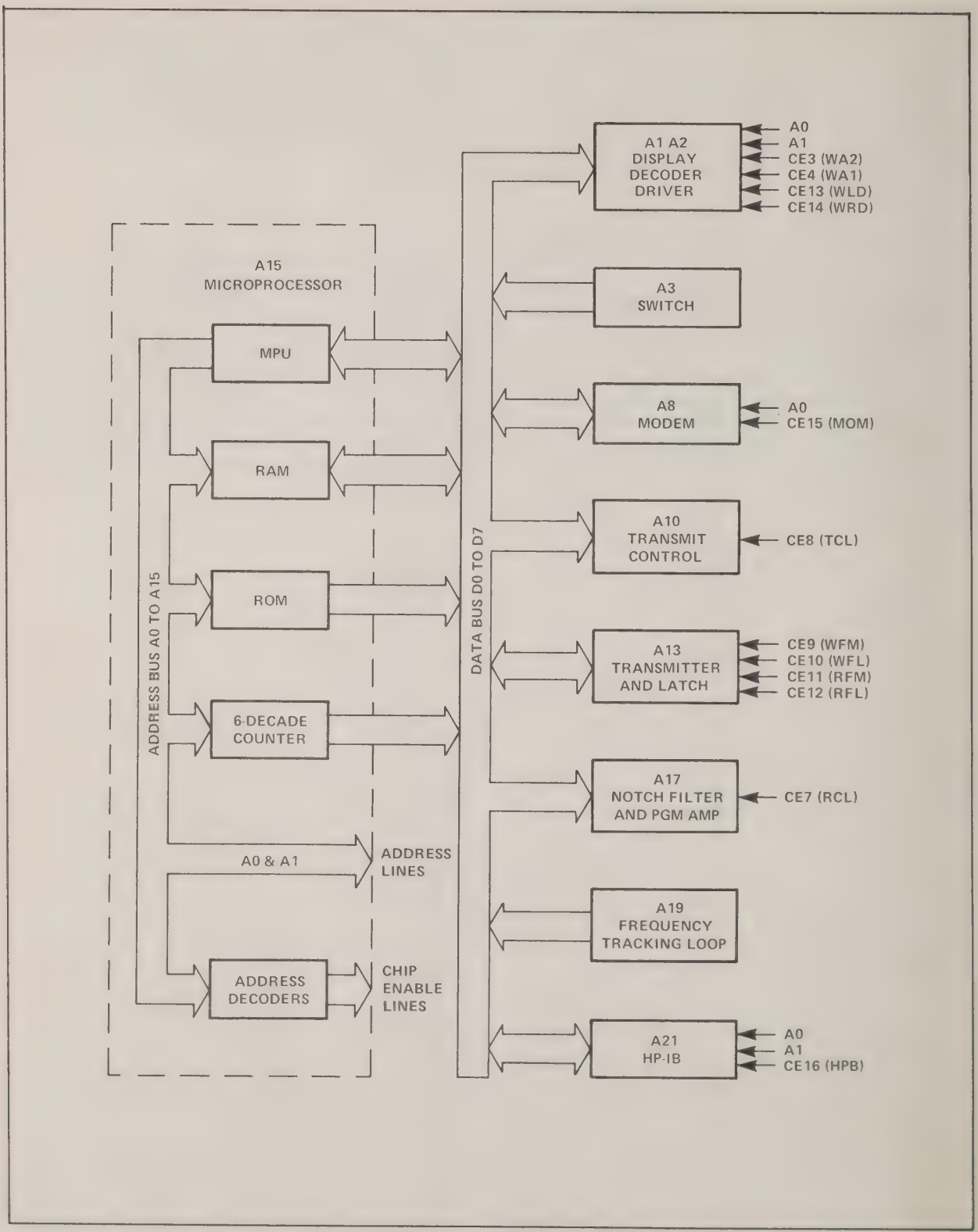


Figure 8-12. Microprocessor Control

8-73. MICROPROCESSOR CONTROL

8-74. The control center of the Model 4942A is the microprocessor assembly. This is where the magic takes place. See Figure 8-12.

8-75. Communication takes place between the microprocessor assembly and the other assemblies over the data bus. This data bus is actually 8 wires in parallel, between the affected circuitry. The bus is shared by its users in the time domain. Only one "talker" is active at any one time, the other talkers are silent. More than one "listener" may be active at any one time.

8-76. Some assemblies only talk (output data onto the bus), such as the A3 switch assembly. Others only listen (receive data from the bus), as the A1A2 display decoder driver. Many boards can do both, such as the A21 HP-IB assembly.

8-77. The MPU (microprocessor unit) chip at A15 commands control of the data bus. This device selects the appropriate talker and listener using the address bus. The address lines and chip enable lines are selectively activated to "latch-in" data into the listeners; and to allow output of data (using tri-state buffers) onto the bus.

8-78. The same data bus and address bus allows communication within the microprocessor assembly. The processor (MPU) is the decision maker or controller of the system. The RAM (random access memory) is the "scratchpad" (or temporary) memory for the processor. The ROM (read only memory) contains the permanent memory for the processor, and contains all firmware. The 6-decade counter is used for such things as counting transmit signal frequency, and is shared by many measurements.

8-79. MNEMONIC DICTIONARY

8-80. Table 8-1 gives a list of all digital control mnemonics used in the Model 4942A. These mnemonics are abbreviations of more complete signal names. For instance, "QTM" represents "Quiet Termination".

8-81. The active state or prefix of the mnemonics is not given in Table 8-1 (ex.: HQTM). An "H" prefix represents an active HIGH state signal; an "L" would be low active. These state prefixes are not given because they change from circuit to circuit. This happens, for instance, when the functional signal is transformed by an inverting buffer. The HQTM signal line is expected to be at a HIGH state during C-message noise measurement.

8-82. A few of the signal lines have a dual mnemonic. The chip enable lines are an example. Figure 8-12 shows some of these. The chip enable lines are essentially "latch enable" signals. The corresponding descriptive mnemonic imparts a functional purpose. For example, "CE16" is also known as "HPB" for Hewlett-Packard Interface Bus Enable".

8-83. LOCATOR DRAWINGS

8-84. Figure 8-13 shows the location of all replaceable assemblies. All plug-in PC boards and plug-in cables are shown for easy identification. Figure 8-14 identifies the components mounted on the front panel, and Figure 8-15 shows the rear panel.

8-85. SCHEMATIC NOTES

8-86. Table 8-2 provides general schematic notes for interpretation of the schematic diagrams. A review of this table will definitely help to understand the schematics in this manual.

Table 8-1. Model 4942A Mnemonic Dictionary (1 of 5)

MNEMONIC	FUNCTION	
ACD	Accept Data	
ACH	Acceptor Hand Shake	
ALC	Automatic Level Control	
ALT	Segment A, Left Dispaly	
AN2 thru AN9	Display Anodes	
ART	Segment A, Right Display	
ATN	Attention	
A/R	Autorange	
A = B	HP-IB Address Present	
BAC	Byte Accepted	
BAV	Bus Available	
BKL	Break Loop	
BLT	Segment B, Left Display	
BPF	Band Pass Filter	
BRG	Bridged	
BRT	Segment B, Right Display	
CE1	Chip Enable 1	
CE2	Chip Enable 2	
CE3	Chip Enable 3	(See WA2)
CE4	Chip Enable 4	(See WA1)
CE5	Chip Enable 5	
CE6	Chip Enable 6	
CE7	Chip Enable 7	(See RCL)
CE8	Chip Enable 8	(See TCL)
CE9	Chip Enable 9	(See WFM)
CE10	Chip Enable 10	(See WFL)
CE11	Chip Enable 11	(See RFM)
CE12	Chip Enable 12	(See RFL)
CE13	Chip Enable 13	(See WRD)
CE14	Chip Enable 14	(See WLD)
CE15	Chip Enable 15	(See MOM)
CE16	Chip Enable 16	(See HPB)
CE17	Chip Enable 17	
CLT	Segment C, Left Display	
CMS	C-Message Noise	
CRT	Segment C, Right Display	
CTR	Counter Enable	
CTS	Counts	
DAC	Data Accepted	
DAV	Data Valid	
DBA	Data Byte Accepted	
DBM	DBM	
DBC	DBRNC	
DBV	Data Byte Valid	
DBX	DB	

Table 8-1. Model 4942A Mnemonic Dictionary (2 of 5)

MNEMONIC	FUNCTION
DCD	Data Carrier Detect
DCL	Device Clear
DI01 thru DI08	Data Input/Output Lines On HP-IB Bus
DLT	Segment D, Left Display
DPL	Decimal Point, Left Dispaly
DRT	Segment D, Right Display
DRV	Drive
DSL	Display Level
DZO	Delay Zero
D/T	Dial/Talk
DØ thru D7	Data Bus Bits
EDD	Envelope Delay Distortion
ELT	Segment E, Left Display
ENW	Enable Weighting Filters
EOI	End or Identify
EOR	End of Range (TRMT Freq.)
ERT	Segment E, Right Display
FLA	Flat Input (no notch)
FLT	Segment F, Left Display
FPD	Front Panel Disable
FP1	Front Panel Enable #1
FP2	Front Panel Enable #2
FP3	Front Panel Enable #3
FP4	Front Panel Enable #4
FRT	Segment F, Right Display
FSK	Frequency Shift Keying
FSP	FSK Present
FST	FSK Transmit
FWA	Full Wave Average
FXF	Fixed Frequency
GET	Group Execute Trigger
GLT	Segment G, Left Display
GRT	Segment G, Right Display
GTL	Go to Local
HLD	Hold
HLT	Halt
HPB	HP-IB Enable (CE16)
HPF	High Pass Filter
IDR	Impulse Noise Sig Dropout
IFC	Interface Clear
ILO	Impulse Noise Loop
IMN	Impulse Noise
IND	Impulse Noise Data
INL	Impulse Noise Latch (CE 19)

Table 8-1. Model 4942A Mnemonic Dictionary (3 of 5)

MNEMONIC	FUNCTION
INP	In Process
IRQ	Interrupt Request
I1M	Inhibit 1 MHz
JSC	Phase Jitter Self Check
LAD	Listener Addressed
LAR	Loop Around
LIS	Listener Block Address
LLB	Line Loop Back
LLS	Load Least Significant Bits
LMS	Load Most Significant Bits
LPF	Low Pass Filter
LZO	Level Zero
L/F	Level & Frequency
MAN	Manual Frequency
MBR	Minus Bar
MLA	My Listen Address
MOM	Modem Enable (CE15)
MRS	Master Reset
MSC	Microseconds
MTA	My Talk Address
MTF	Monitor Transmit Frequency
MTL	Monitor Transmit Level
MTS	Master-to-Slave
M83	83-1/3Hz from Modem
NCH	Notch
NMD	Normal (Delay Switch)
NMI	Non-Maskable Interrupt
NMR	Normal (Remote Switch)
NSP	Non-Stop
NWT	Noise-with-Tone
OOR	Out of Range
OTA	Other Talk Address
OVF	Overflow
OVR	Override
PBR	Plus Bar
PCD	Phase Correction Disable
PEN	Polarity Enable
PLD	Parallel Load Frequency Counters
PLT	FSK Pilot Present
PSE	Polarity Select
QRM	Quasi RMS Detector
QTM	Quiet Termination
QTZ	Quantize
RCL	Receive Latch (CE7)

Table 8-1. Model 4942A Mnemonic Dictionary (4 of 5)

MNEMONIC	FUNCTION
RCV	Receive
REM	Remote
REN	Remote Enable
RES	Reset/Start
REV	Reverse
RFD	Ready for Data
RFL	Read Frequency Least Significant Bits (CE12)
RFM	Read Frequency Most Significant Bits (CE11)
RHZ	Receive Hz
RSG	Receive Sig Select
R83	Receive 83-1/3 Hz to Modulator
SCK	Self Check
SDN	Step Down
SFS	Single Frequency Skip
SKP	Skip 2450 to 2750 Hz
SLA	Slave
SLR	Slave (Remote Switch)
SPA	Serial Poll Active
SPD	Serial Poll Disable
SPE	Serial Poll Enable
SPM	Serial Poll Mode
SRQ	Service Request
STM	Slave-to-Master
STN	Signal-to-Noise Ratio
STP	Stop
SUP	Step Up
SWF	Select Weighting Filters
SYR	System Reset
SYS	System Set
TAC	Talker Active
TAD	Talker Address
TCL	Transmit Control Latch (CE8)
THZ	Transmit Hz
TKB	Talk Battery
TLK	Talk Block Address
TMN	Transmit Level Monitor
TMT	Display Connected to Transmitter
T83	Transmit 83-1/3 Hz to Modulator
UNL	Unlisten
VMA	Valid Memory Address
WA1	Write Annunciator #1
WA2	Write Annunciator #2
WFL	Write Frequency, Least Significant Bit (CE10)

Table 8-1. Model 4942A Mnemonic Dictionary (5 of 5)

MNEMONIC	FUNCTION
WFM	Write Frequency, Most Significant Bit (CE9)
WLD	Write Left Display
WRD	Write Right Display
4KF	4 kHz Low Pass Filter Select
15M	15 Minutes
3KF	3 kHz Low Pass Filter Select
600	600 Ohms
900	900 Ohms

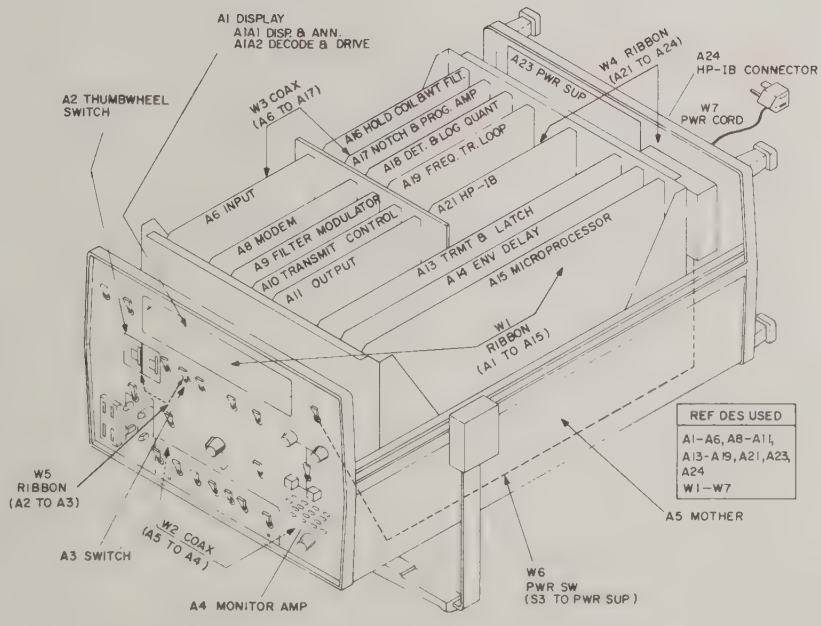


Figure 8-13. Replaceable Assembly Locator

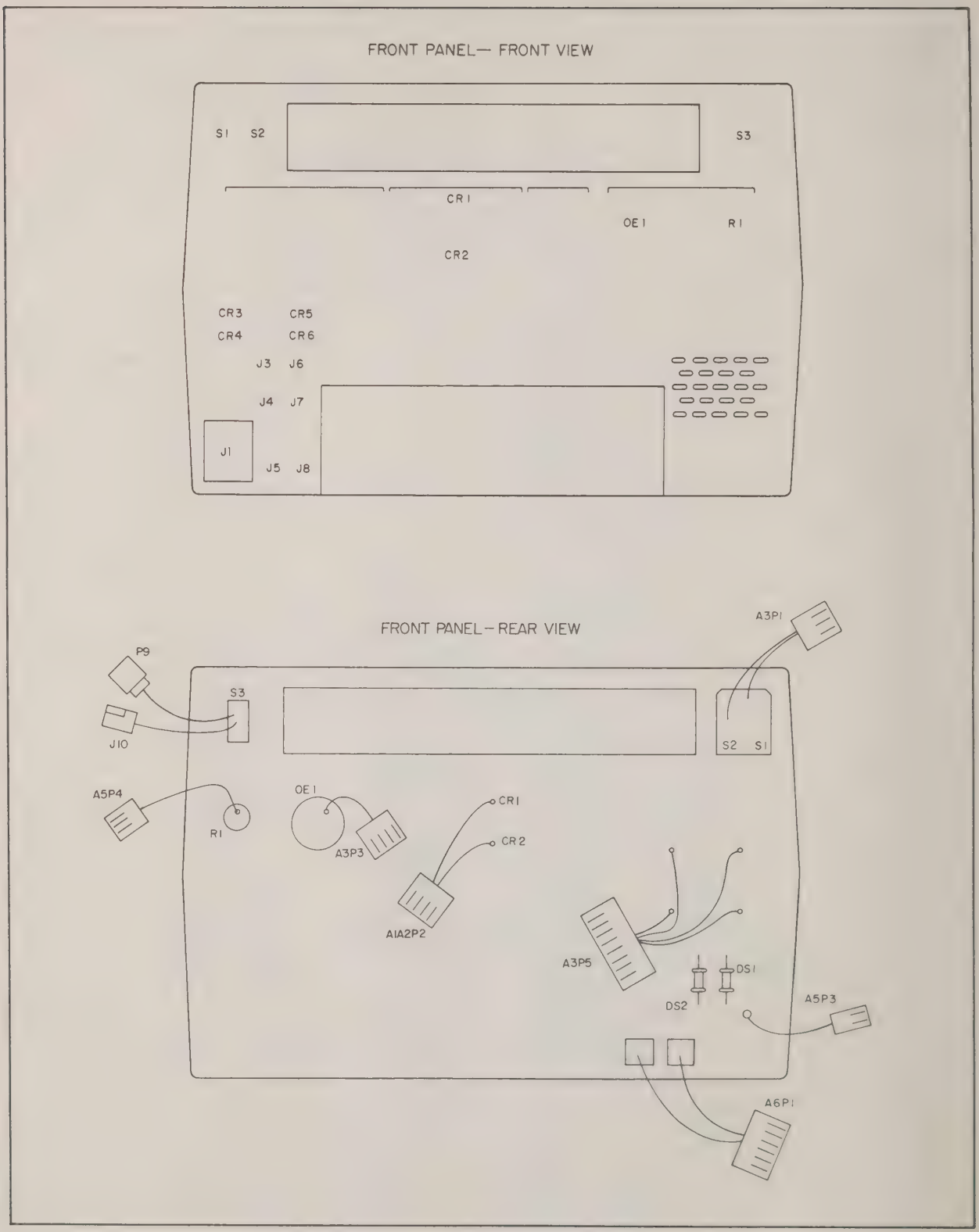


Figure 8-14. Front Panel Area Parts Locator

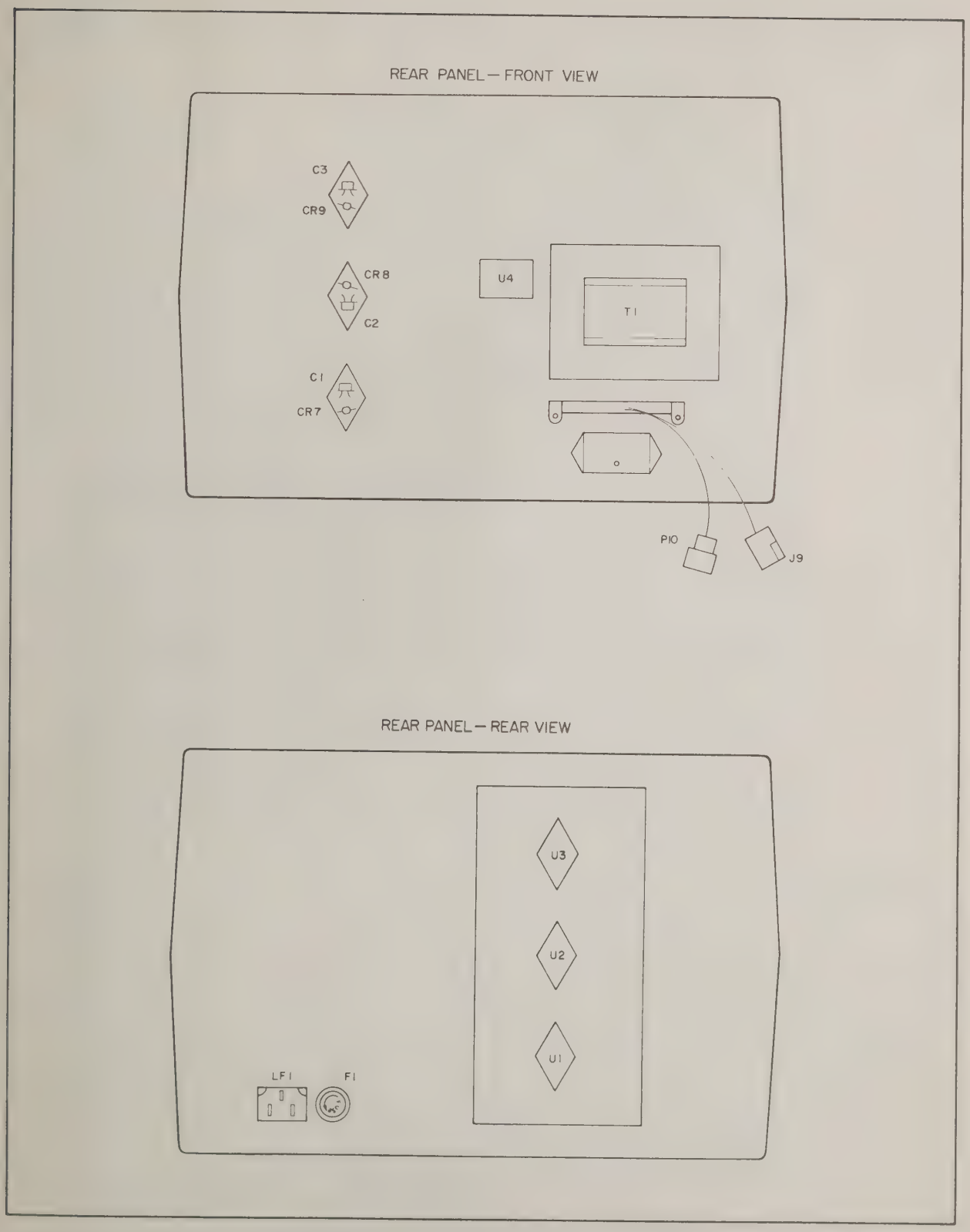


Figure 8-15. Rear Panel Area Parts Locator

Table 8-2. General Schematic Notes

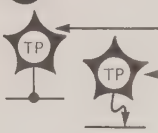
1. Component values are shown as follows unless otherwise noted:

   Resistance in ohms.
   Capacitance in microfarads.
   Inductance in millihenrys.

2. P/O = part of.

3. Denotes wire color: Color code same as resistor color code. First number identifies base color, second number identifies wide strip, third number identifies narrow strip (e.g. (924) denotes white base, red wide strip, yellow narrow strip).

4. Screwdriver adjustment.

5. 

   Test point. (Test points shown in this way are gold plated male pins.)

   Test point. (Test points shown in this way are accessible at the PC board tongue connector using a service extender board.)

6. PC board assembly outline.

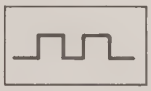
    Circuit stage outline.

    Other assembly outline. Also used to indicate mechanical interconnection (ganging).

7.

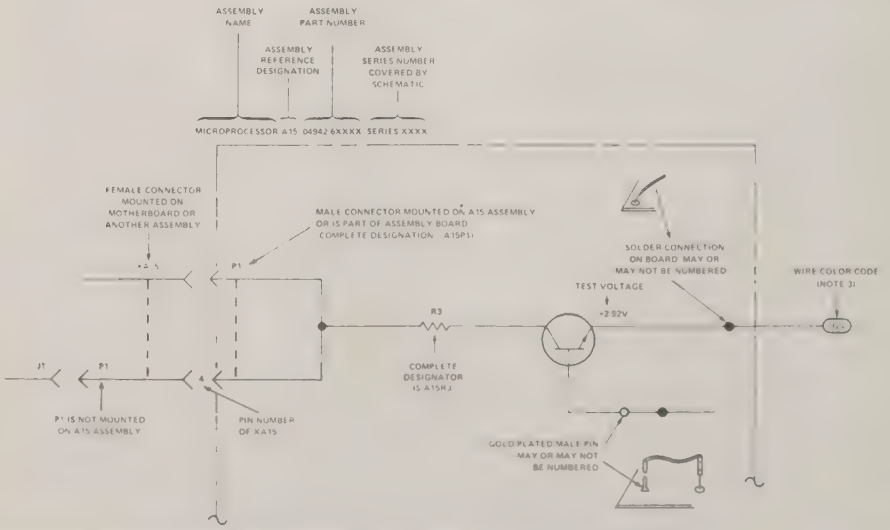
   Circuit common.

8. Denotes front panel marking.

9.  Waveforms and ac voltage measurements were made with respect to circuit common using an oscilloscope. The voltage levels shown on the waveforms are actual voltage levels and are not to be confused with oscilloscope setting. The voltage levels shown are nominal and may vary from one instrument to another. A variation of ±10% should be allowed.

10. +2.92V — DC voltage levels were measured with respect to circuit common using a VTVM with 10 megohm input impedance. The voltage levels shown are nominal and may vary from one instrument to another. A variation of ±10% should be allowed.

11. A15R3 — Reference designations. Partial reference designations are shown. Prefix with assembly designation for complete reference. See following drawing.


ASSEMBLY NAME
ASSEMBLY PART NUMBER
ASSEMBLY REFERENCE DESIGNATION
ASSEMBLY SERIES NUMBER COVERED BY SCHEMATIC
MICROPROCESSOR A15 04942-6XXXX SERIES XXXX
FEMALE CONNECTOR MOUNTED ON MOTHERBOARD OR ANOTHER ASSEMBLY
MALE CONNECTOR MOUNTED ON A15 ASSEMBLY OR IS PART OF ASSEMBLY BOARD COMPLETE DESIGNATION A15P1
P1
J1
P1 IS NOT MOUNTED ON A15 ASSEMBLY
PIN NUMBER OF XA15
R3
COMPLETE DESIGNATOR IS A15R3
SOLDER CONNECTION ON BOARD MAY OR MAY NOT BE NUMBERED
TEST VOLTAGE
+2.92V
WIRE COLOR CODE (NOTE 3)
GOLD PLATED MALE PIN MAY OR MAY NOT BE NUMBERED

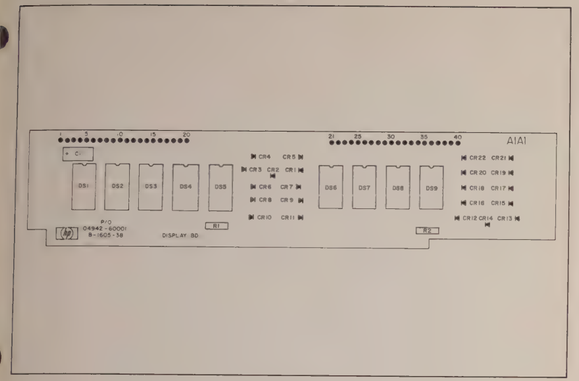
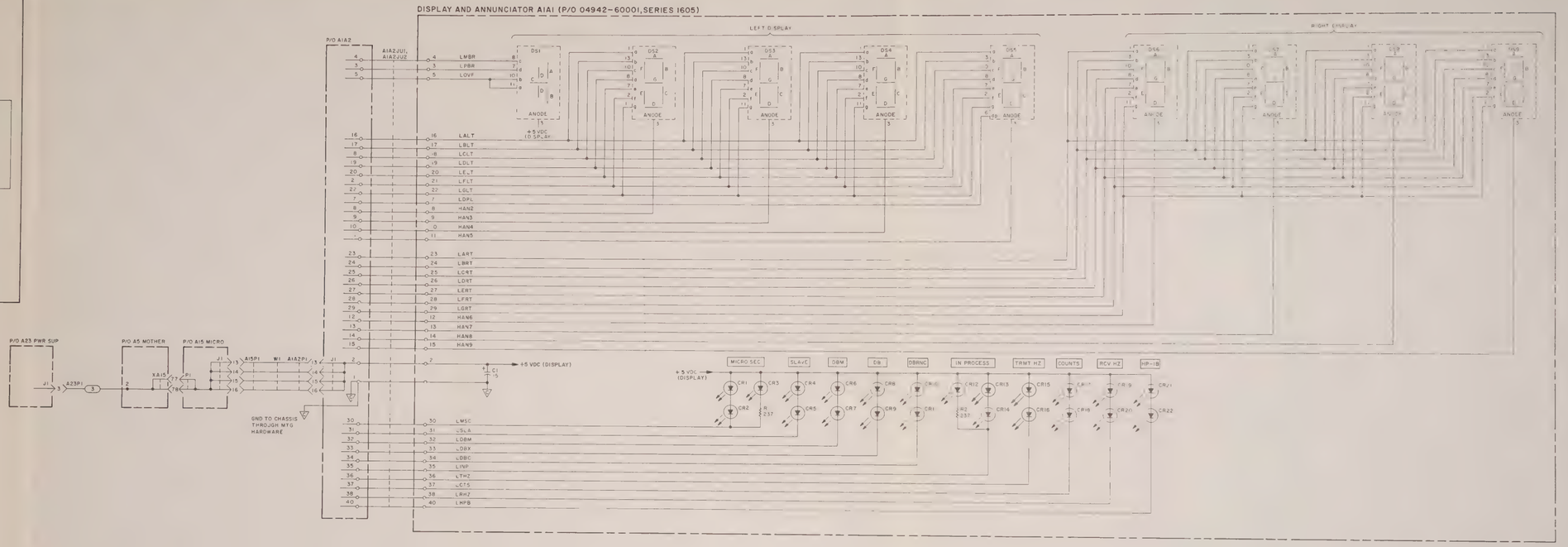


Figure 8-16. Display and Annunciator A1A1 Component Locator



REF DES USED CHASSIS
*

REF DES USED A1A1
CR1 – CR22 DS1 – DS9 C1 R1, R2

Figure 8-17. Display and Annunciator A1A1 Schematic Diagram

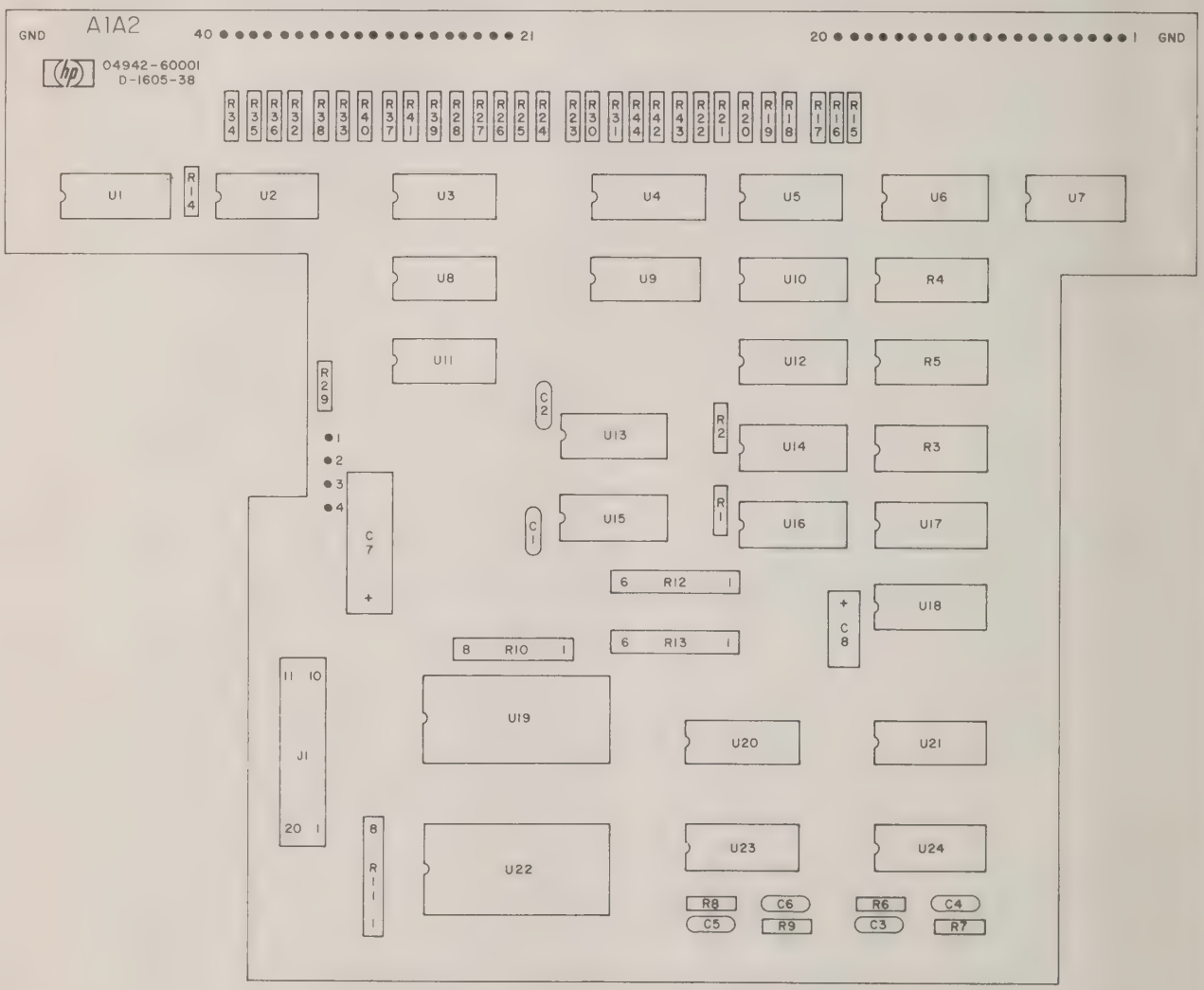
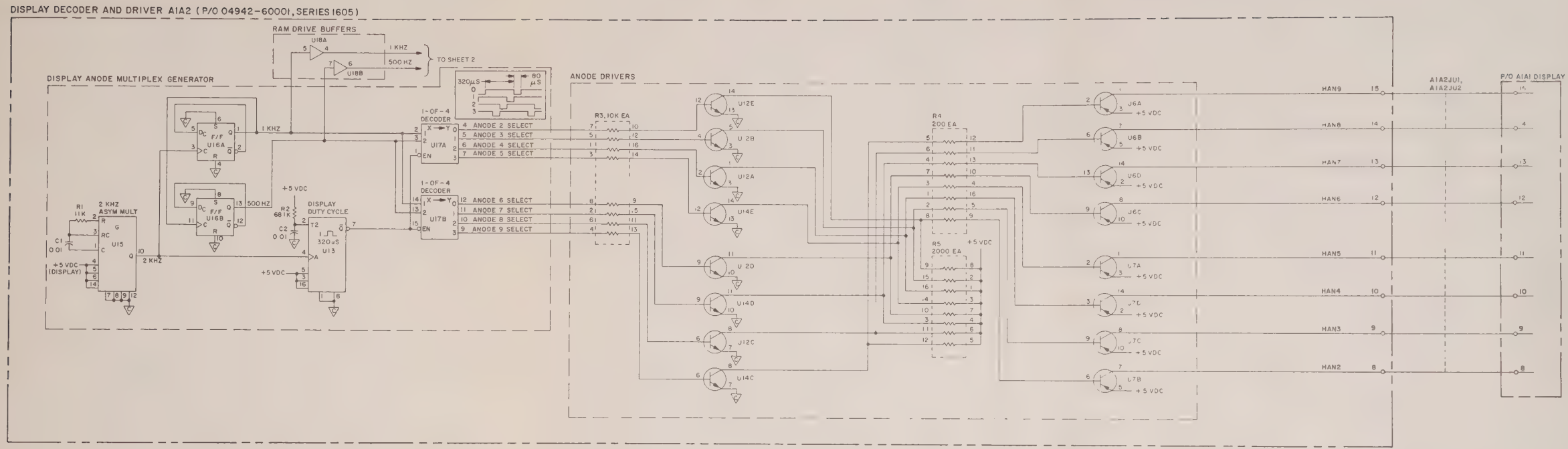


Figure 8-18. Display Decoder and Driver A1A2 Component Locator



REF DES USED - A1A2
C1 - C8
J1, J2
JU1, JU2
R1 - R44
U1 - U24

REF DES USED - CHASSIS
A1A2P2
CR1, CR2

Figure 8-19. Display Decoder and Driver A1A2 Schematic Diagram (1 of 2)

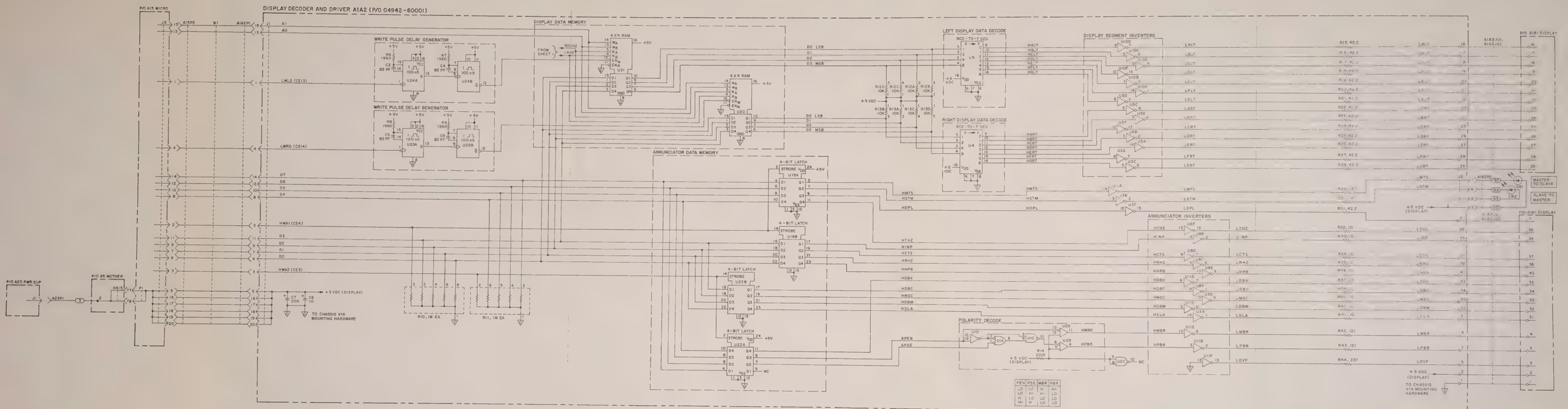


Figure 8-20. Display Decoder and Driver A1A2
Schematic Diagram (2 of 2)

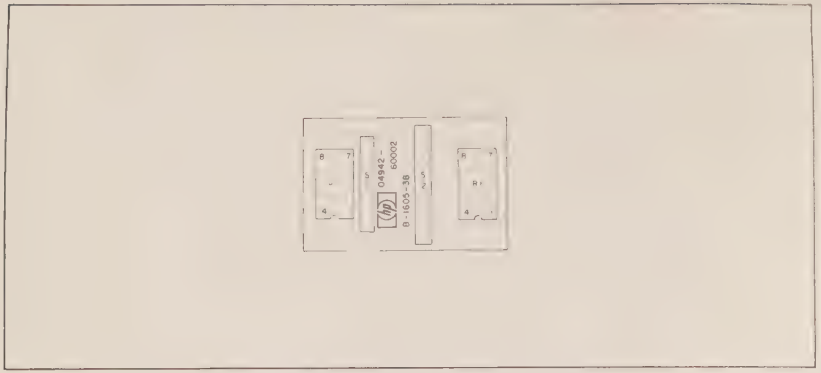


Figure 8-21. Thumbwheel Switch A2 Component Locator

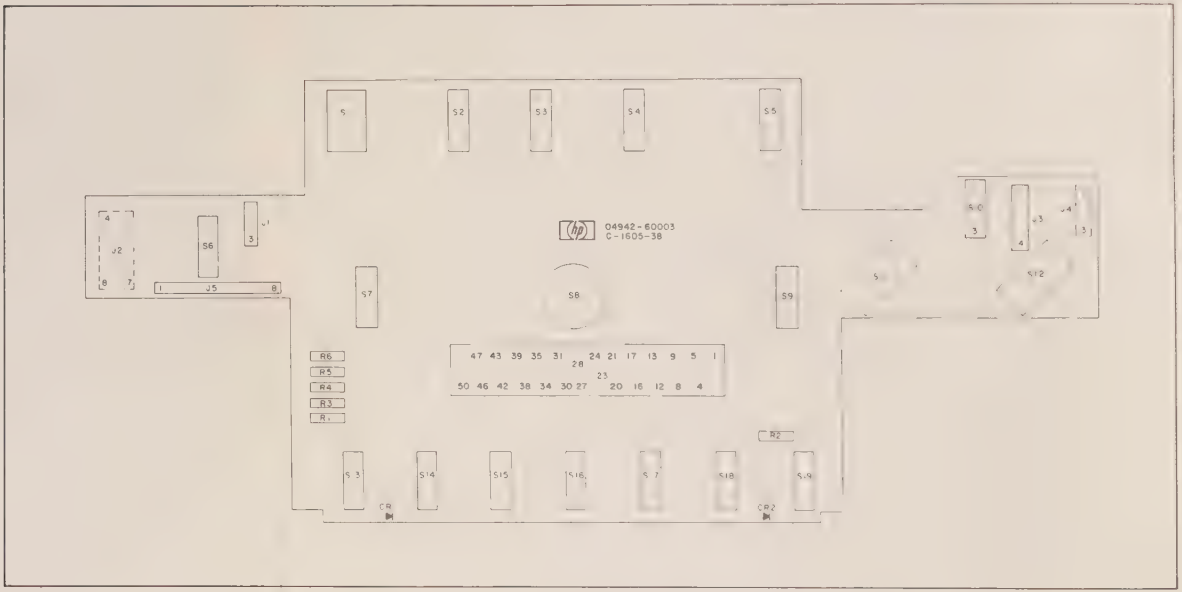


Figure 8-22. Switch A3 Component Locator

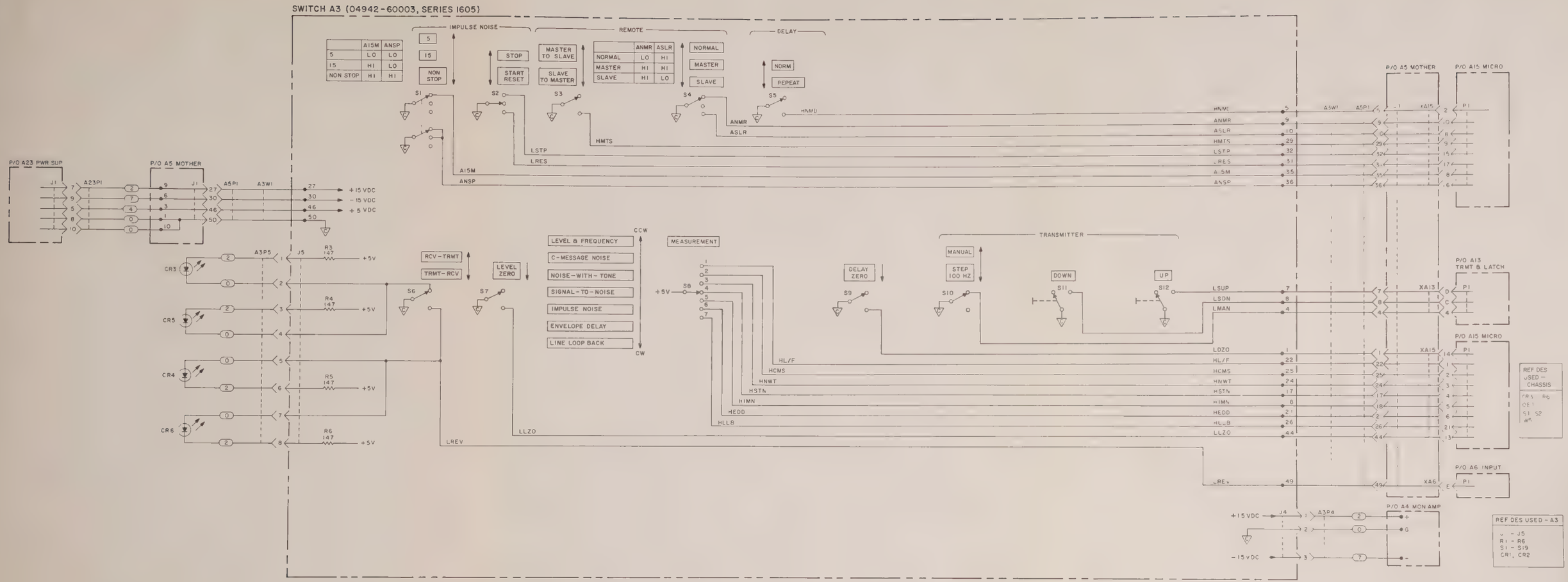
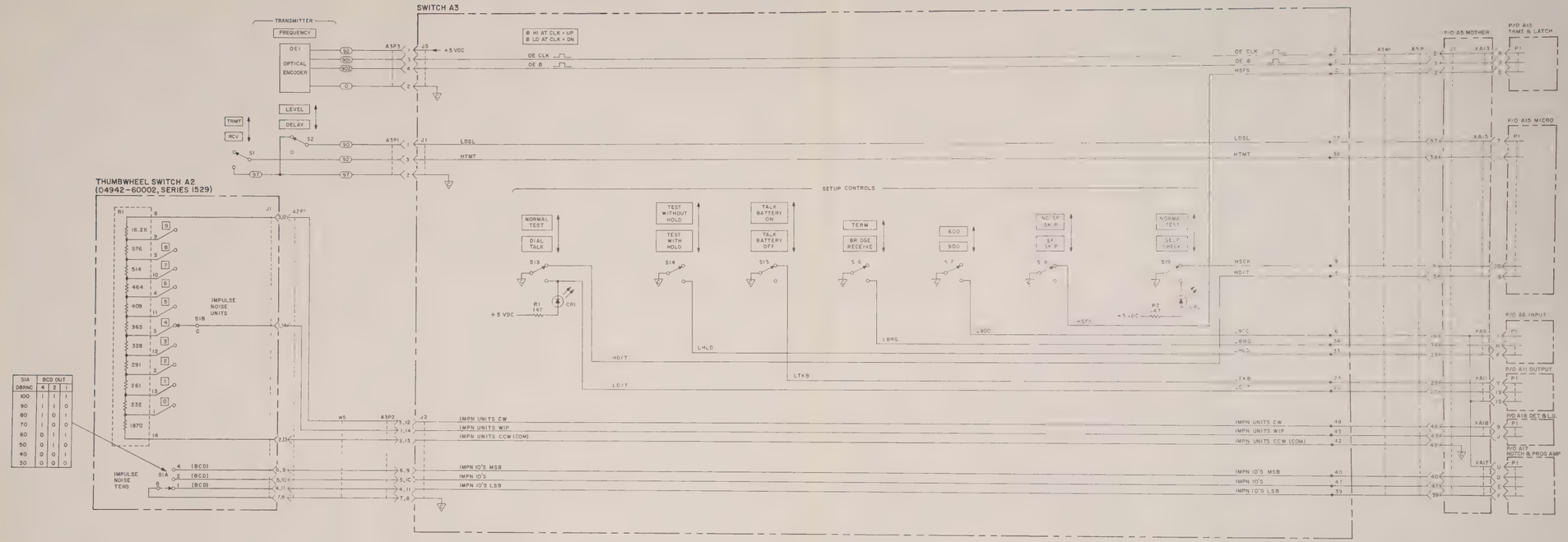


Figure 8-23. Thumbwheel Switch A2 and Switch A3 Schematic Diagram (1 of 2)



SIA	BCD OUT		
DBINC	4	2	1
100	1	1	1
90	1	1	0
80	1	0	1
70	1	0	0
60	0	1	1
50	0	1	0
40	0	0	1
30	0	0	0

Figure 8-24. Thumbwheel Switch A2 and Switch A3 Schematic Diagram (2 of 2)

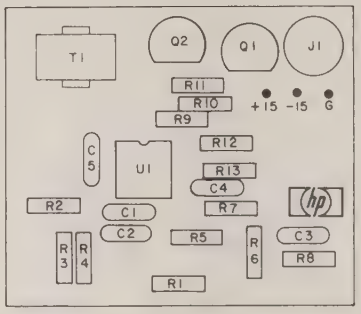


Figure 8-25. Monitor Amplifier A4 Component Locator

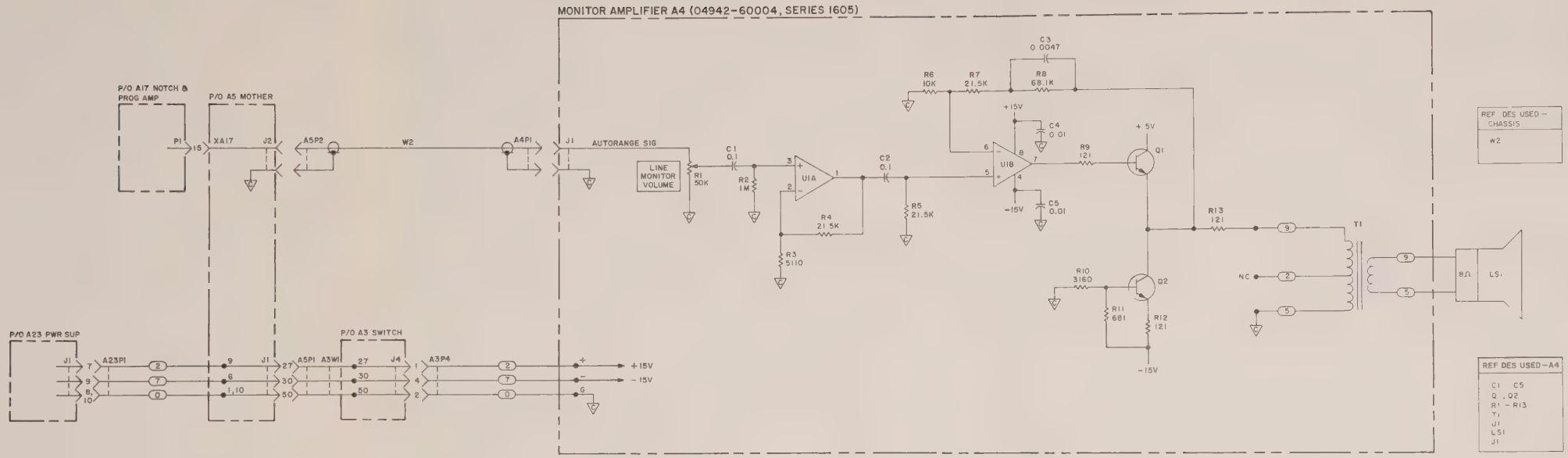


Figure 8-26. Monitor Amplifier A4 Schematic Diagram

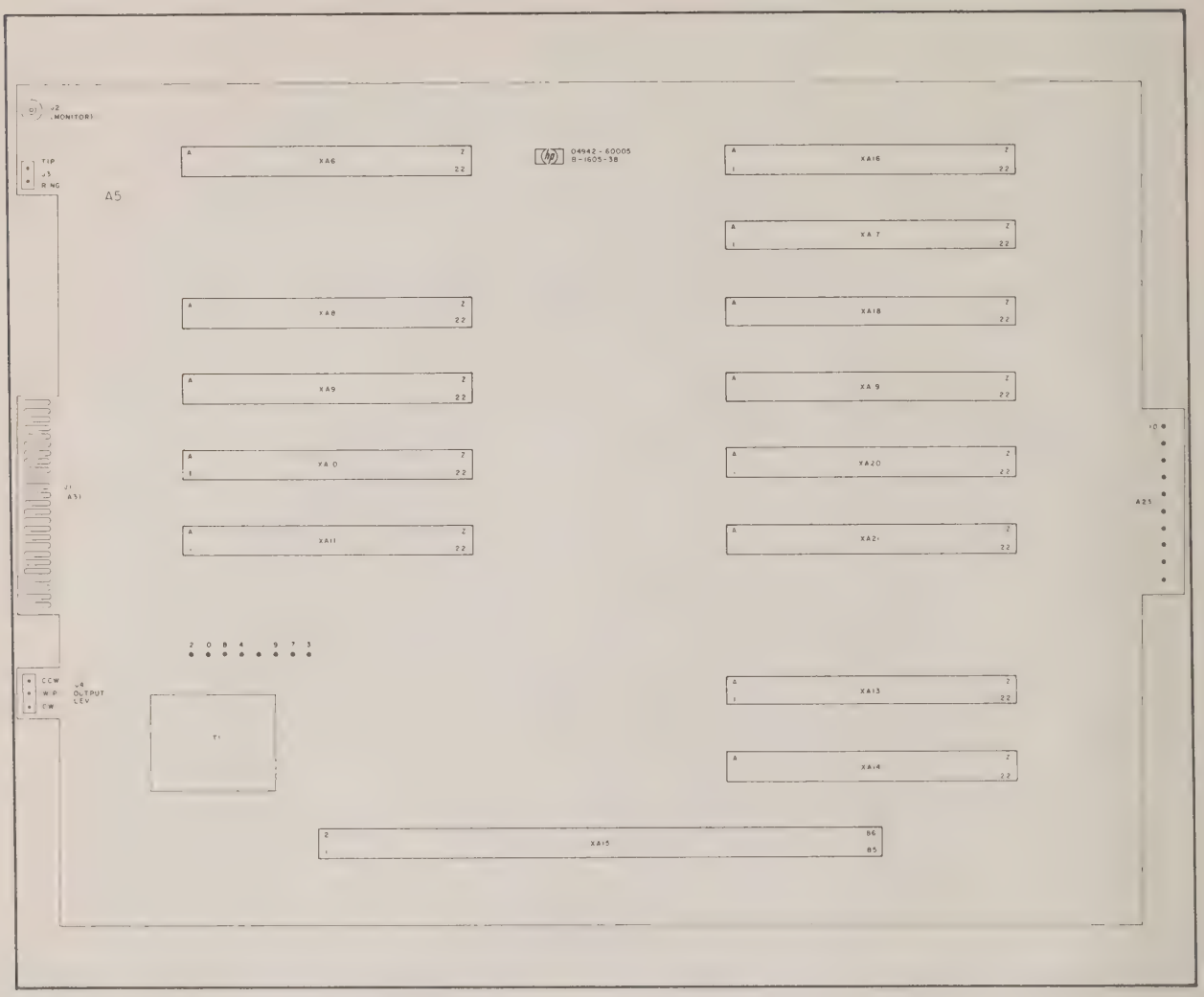


Figure 8-27. Mother A5 Component Locator

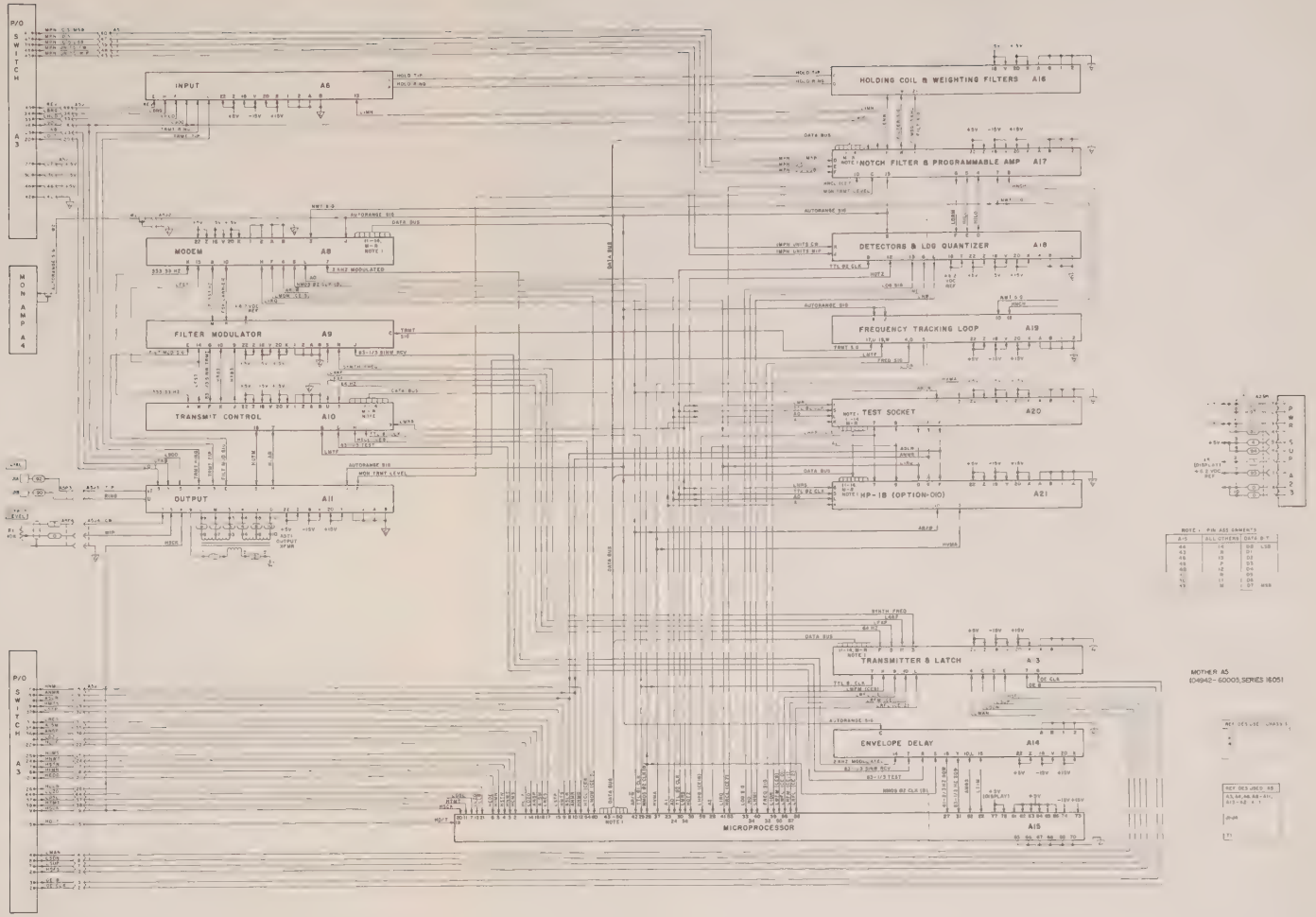


Figure 8-28. Mother A5 Schematic Diagram

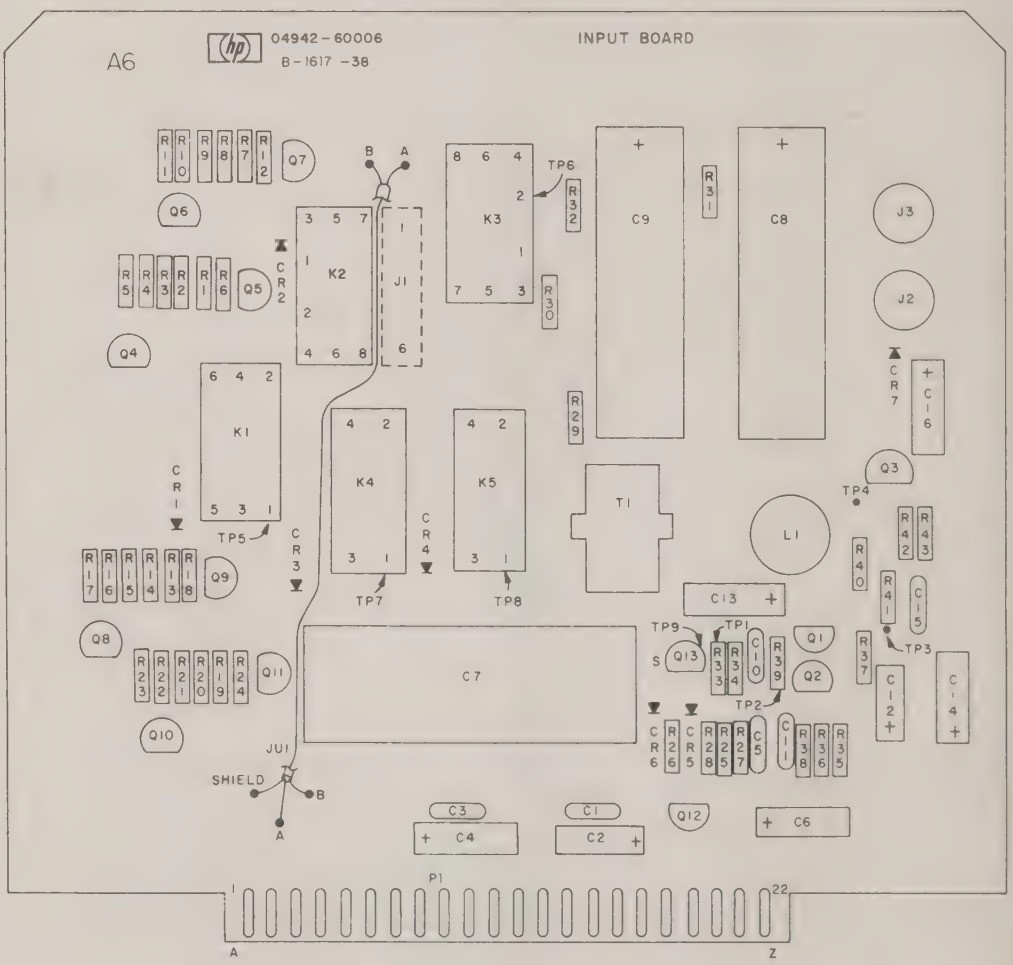


Figure 8-29. Input A6 Component Locator

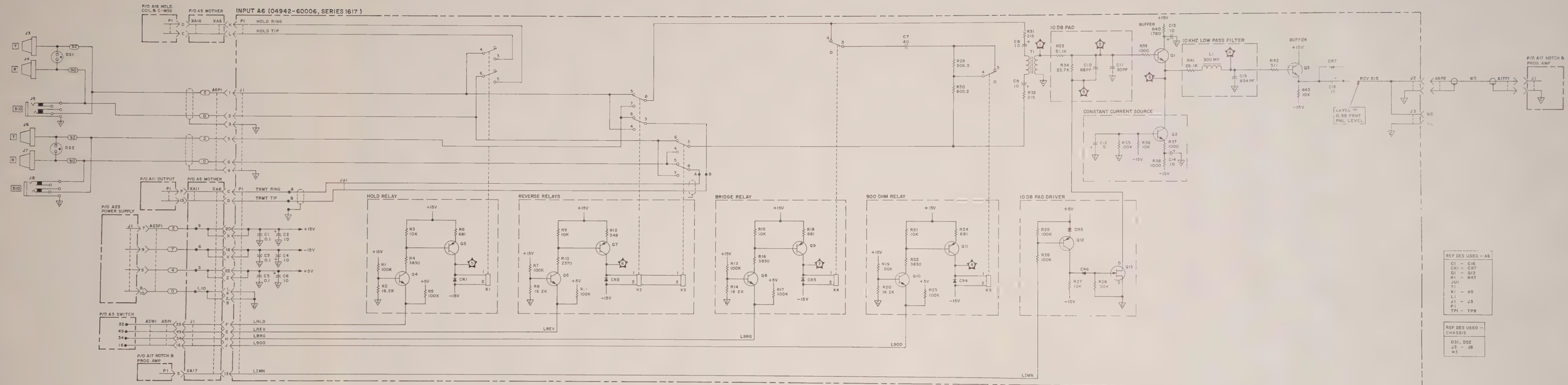


Figure 8-30. Input A6 Schematic Diagram

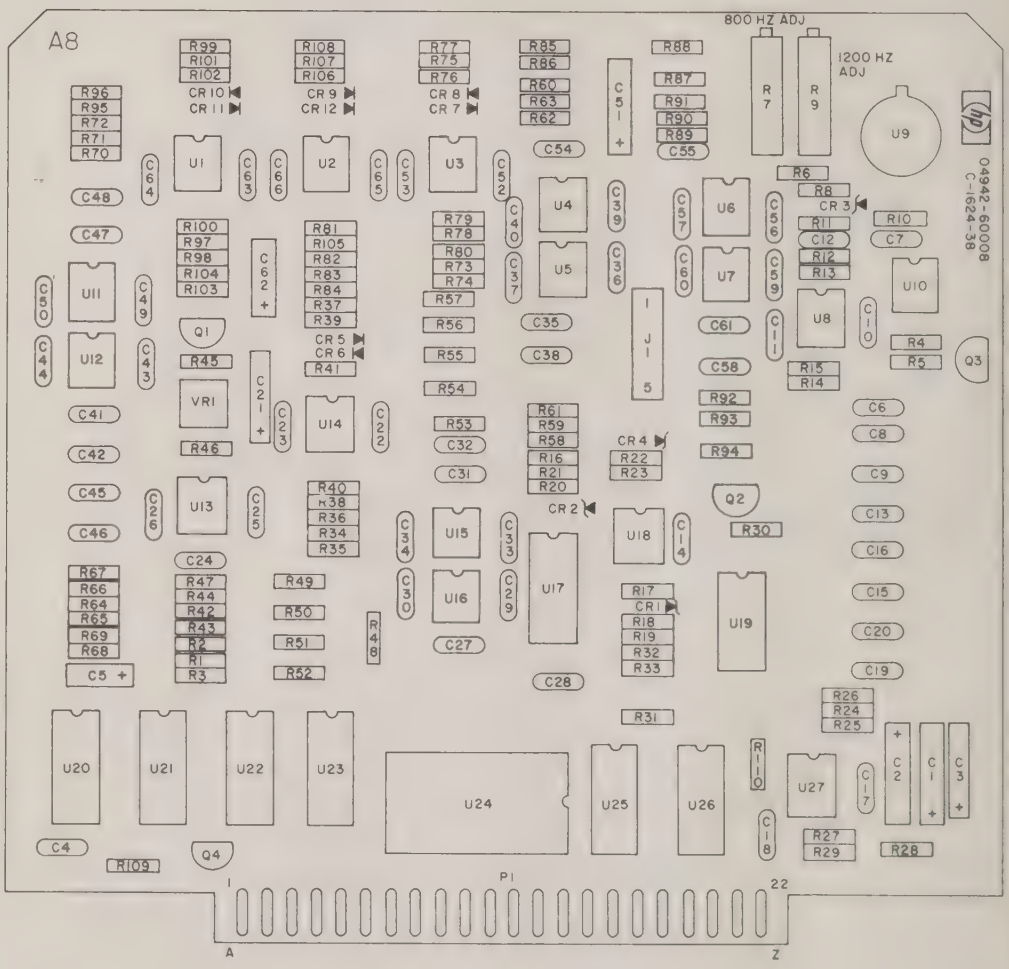


Figure 8-31. Modem A8 Component Locator

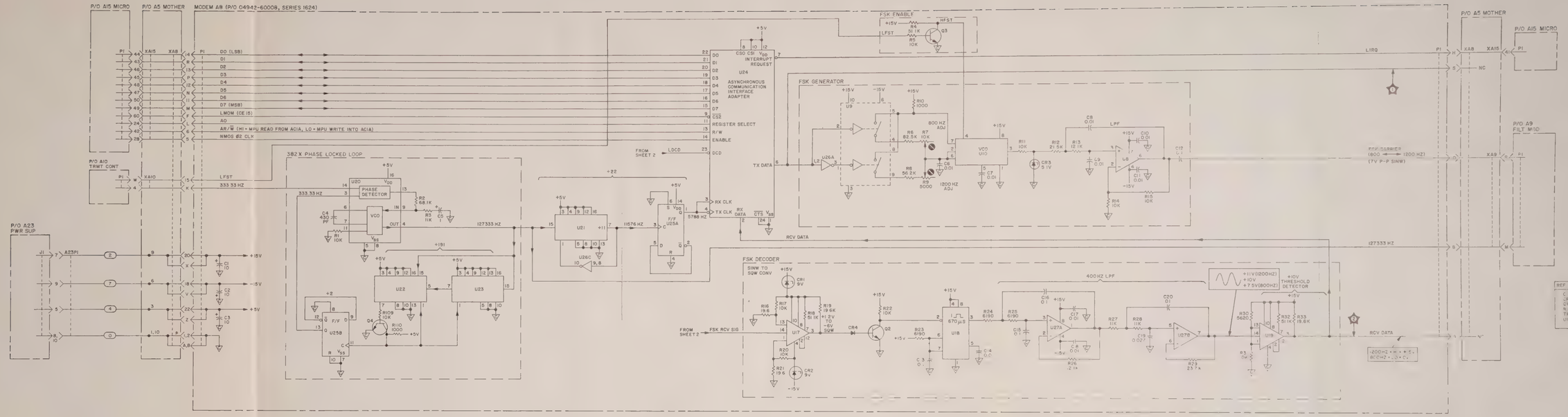


Figure 8-32. Modem A8 Schematic Diagram (1 of 2)

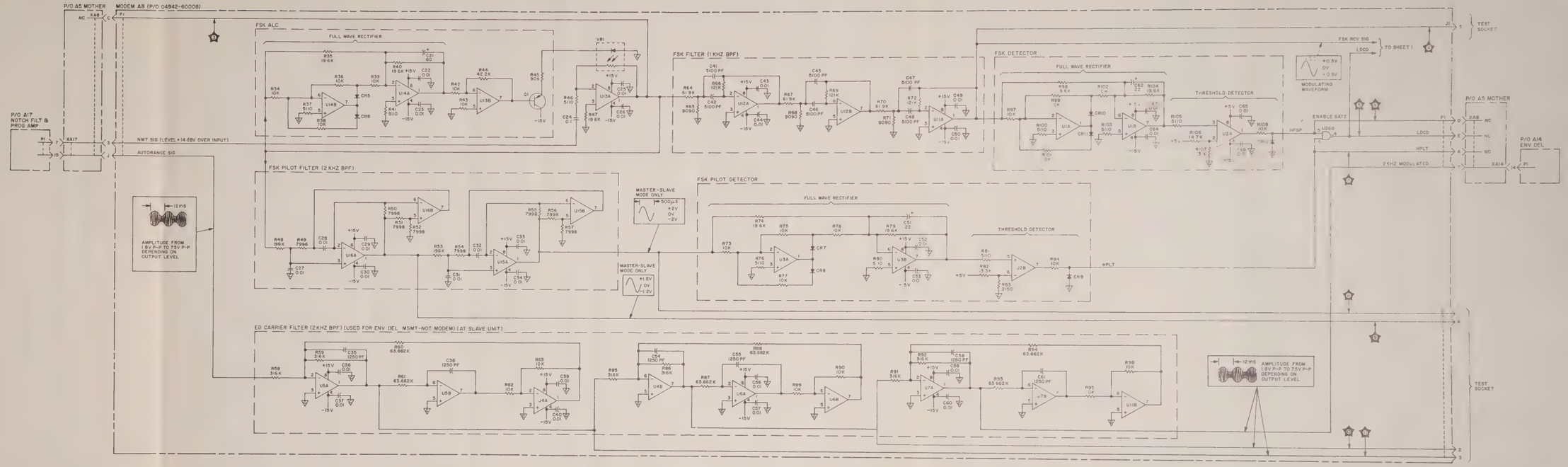


Figure 8-33. Modem A8 Schematic Diagram (2 of 2)

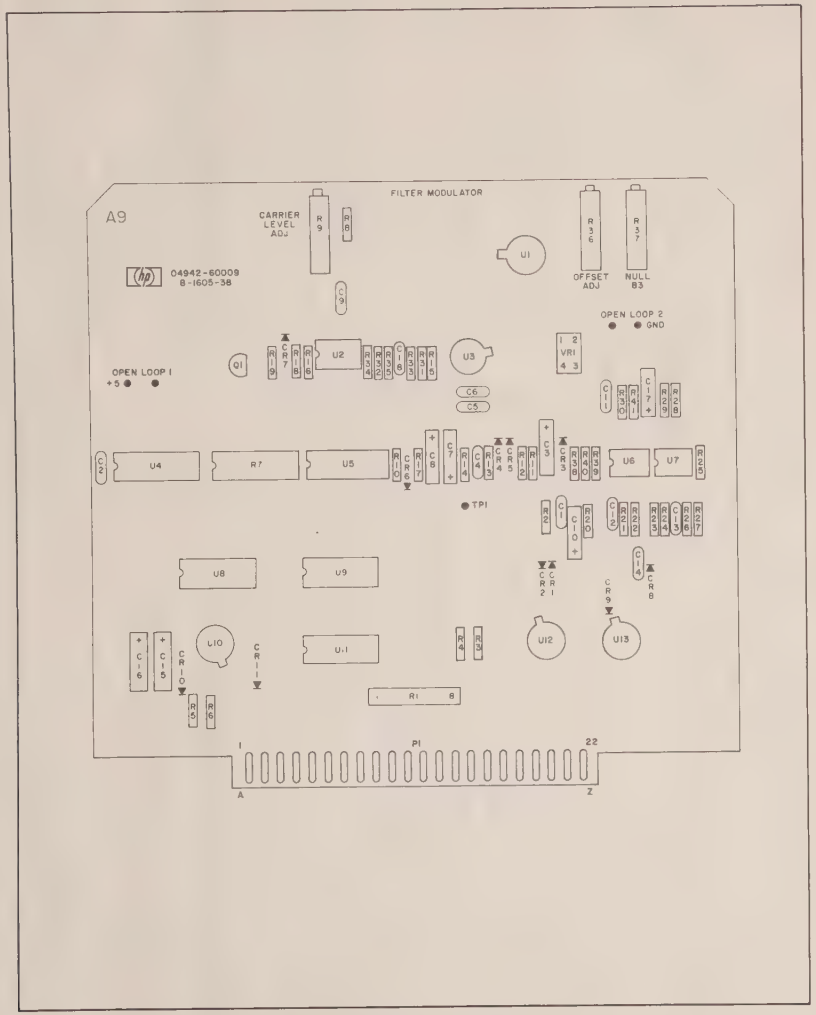


Figure 8-34. Filter Modulator A9 Component Locator

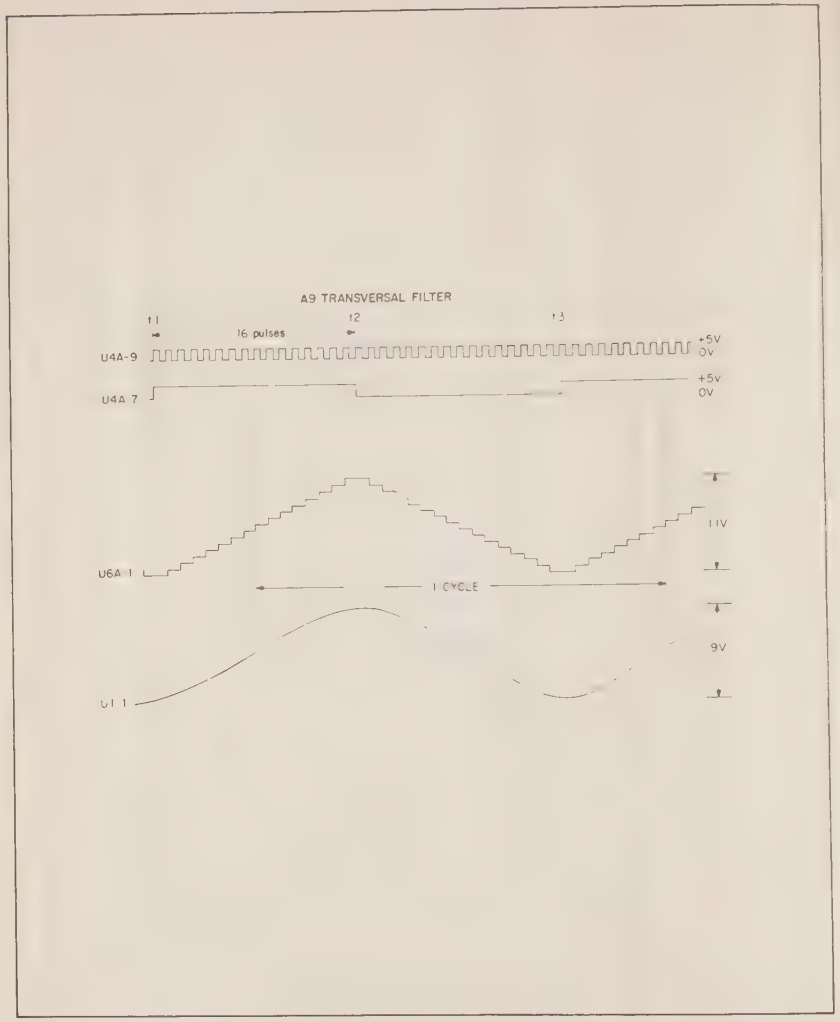


Figure 8-35. Transversal Filter Waveforms

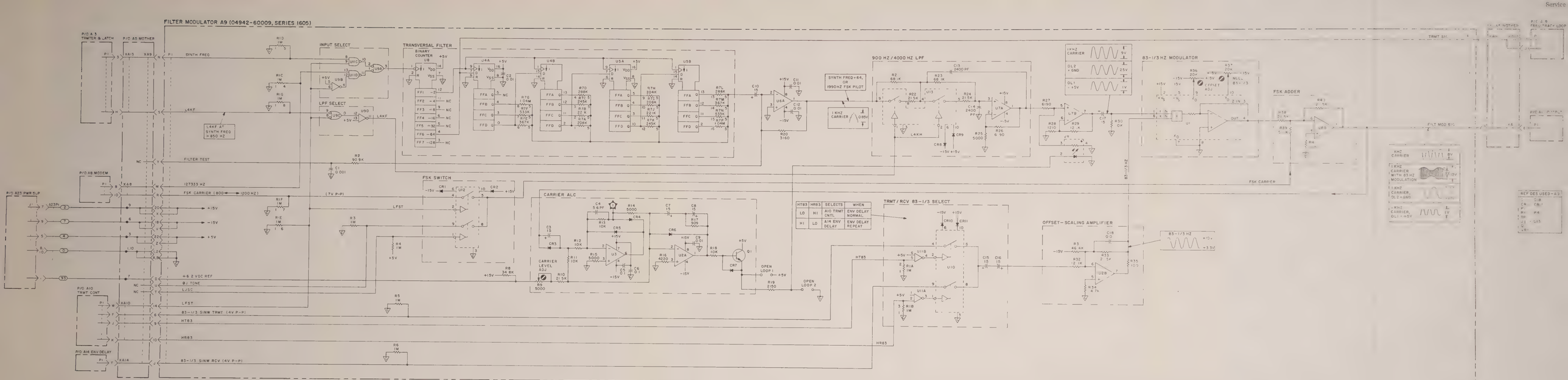


Figure 8-36. Filter Modulator A9 Schematic Diagram

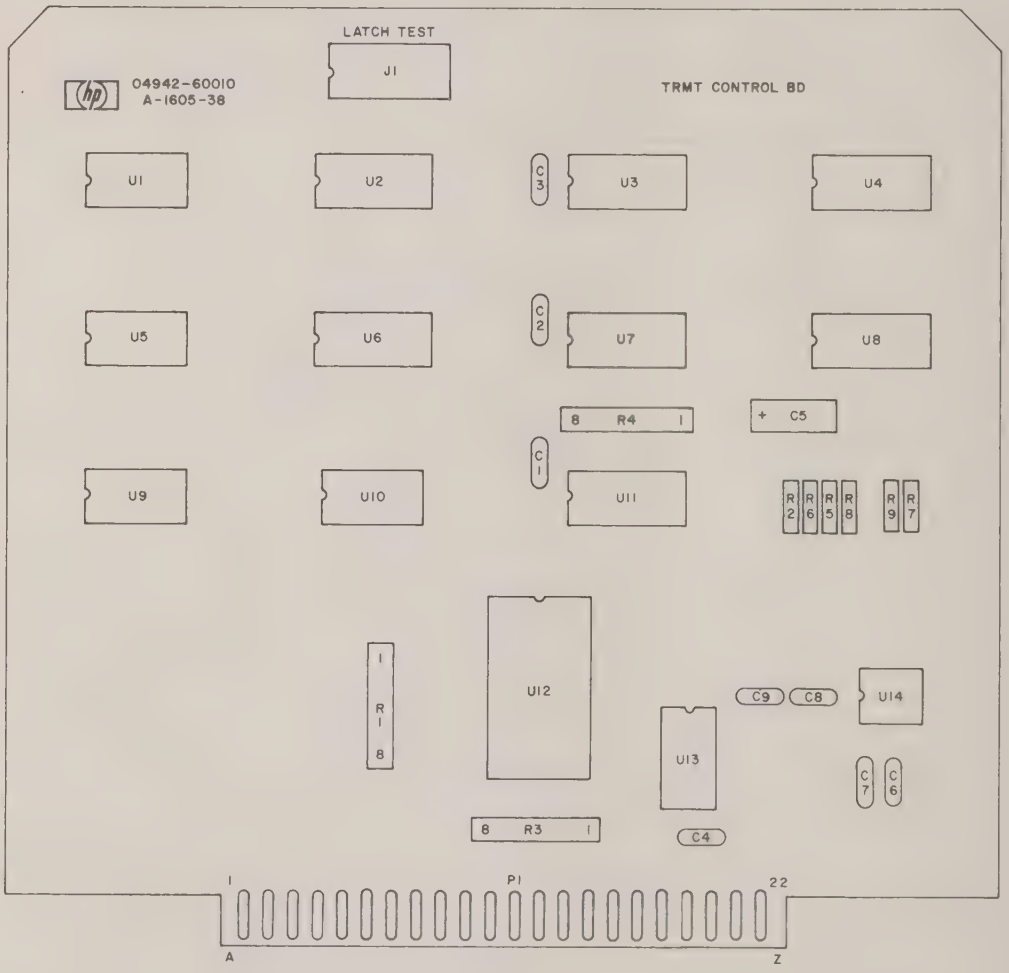


Figure 8-37. Transmit Control A10 Component Locator

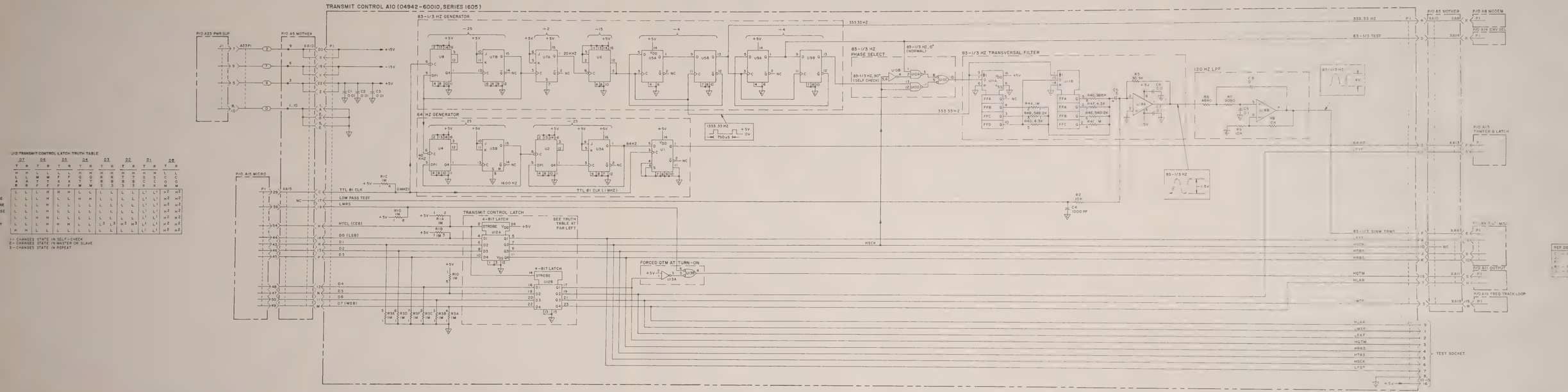


Figure 8-38. Transmit Control A10 Schematic Diagram

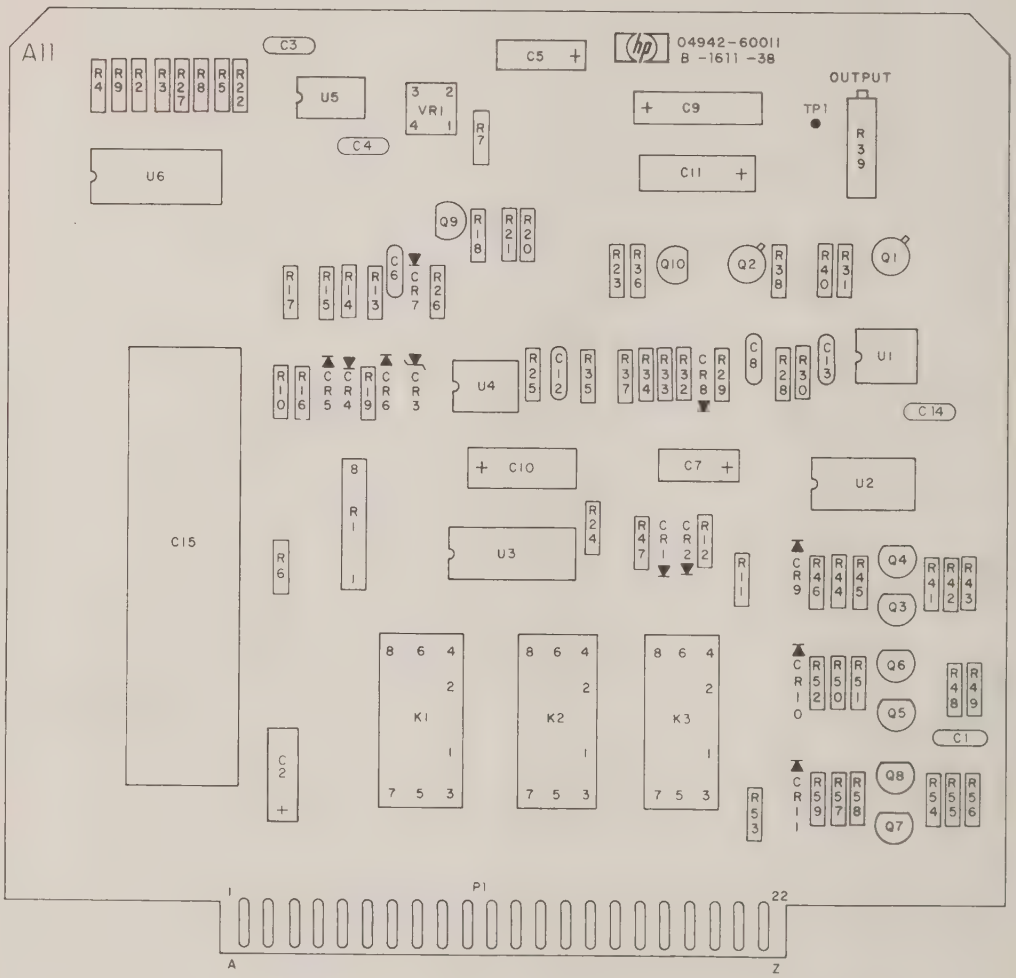
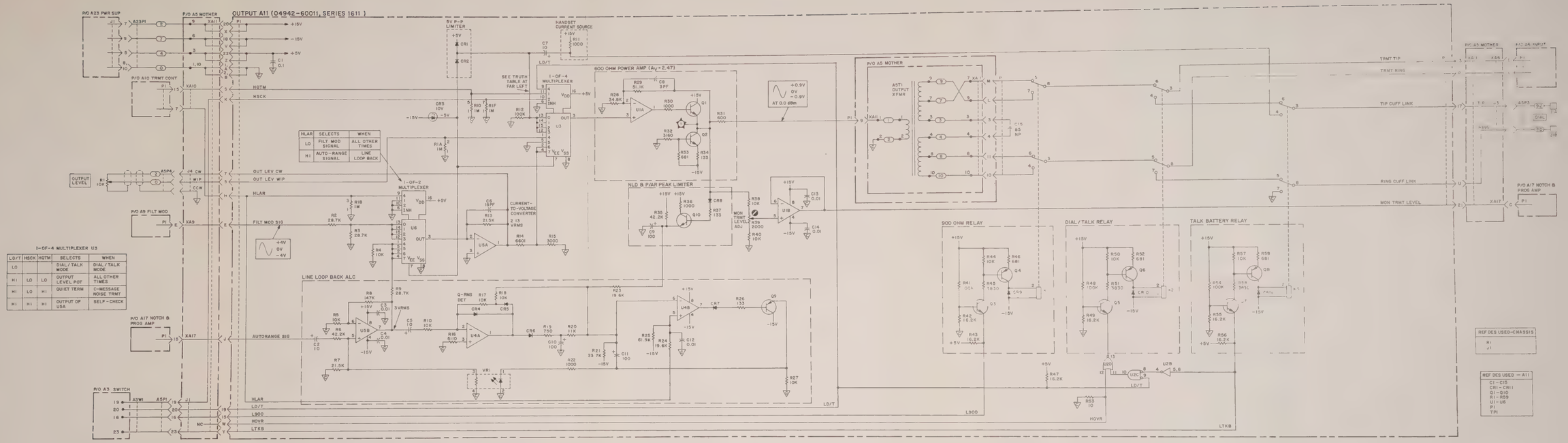


Figure 8-39. Output A11 Component Locator



HLAR	SELECTS	WHEN
LO	FILT MOD SIGNAL	ALL OTHER TIMES
HI	AUTO-RANGE SIGNAL	LINE LOOP BACK

LD/T	HSCK	HQTM	SELECTS	WHEN
LO			DIAL/TALK MODE	DIAL/TALK MODE
HI	LO	LO	OUTPUT LEVEL POT	ALL OTHER TIMES
HI	LO	HI	QUIET TERM	C-MESSAGE NOISE TRMT
HI	HI	HI	OUTPUT OF USA	SELF-CHECK

Figure 8-40. Output A11 Schematic Diagram

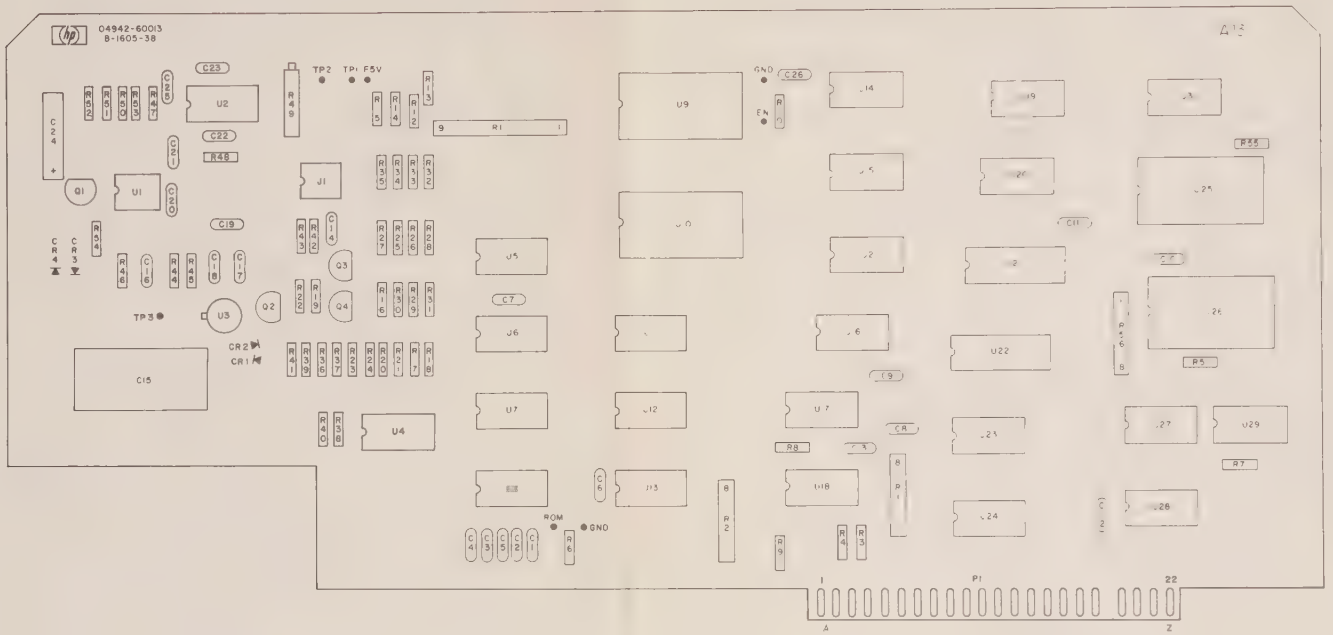


Figure 8-41. Transmitter and Latch A13 Component Locator

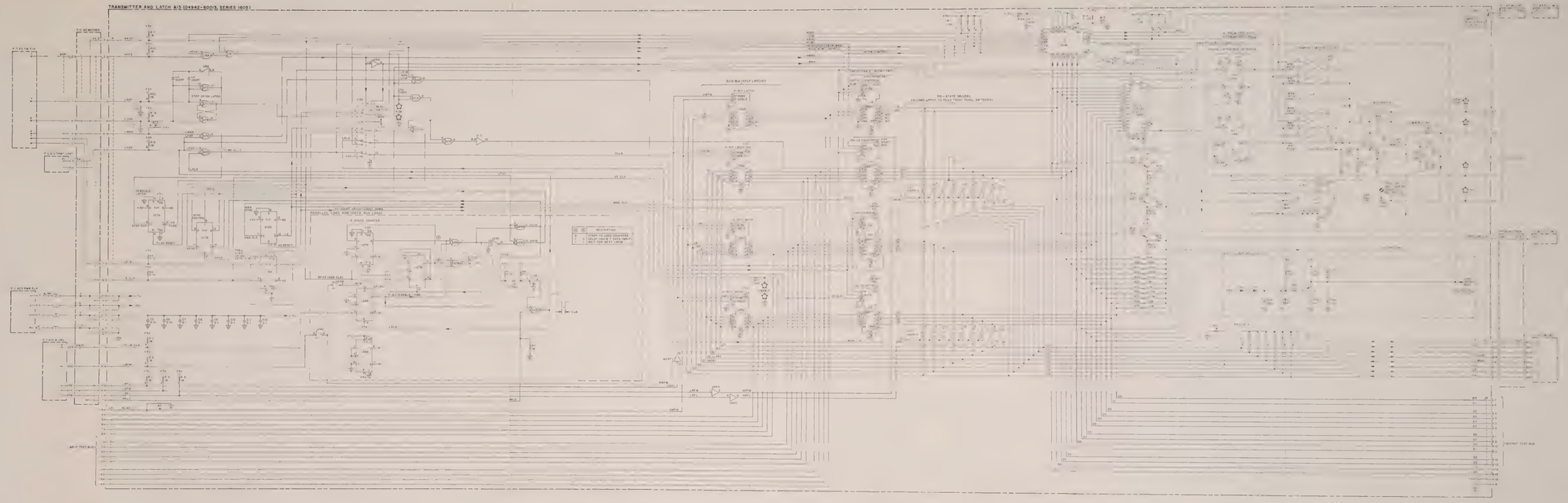


Figure 8-42. Transmitter and Latch A13
Schematic Diagram

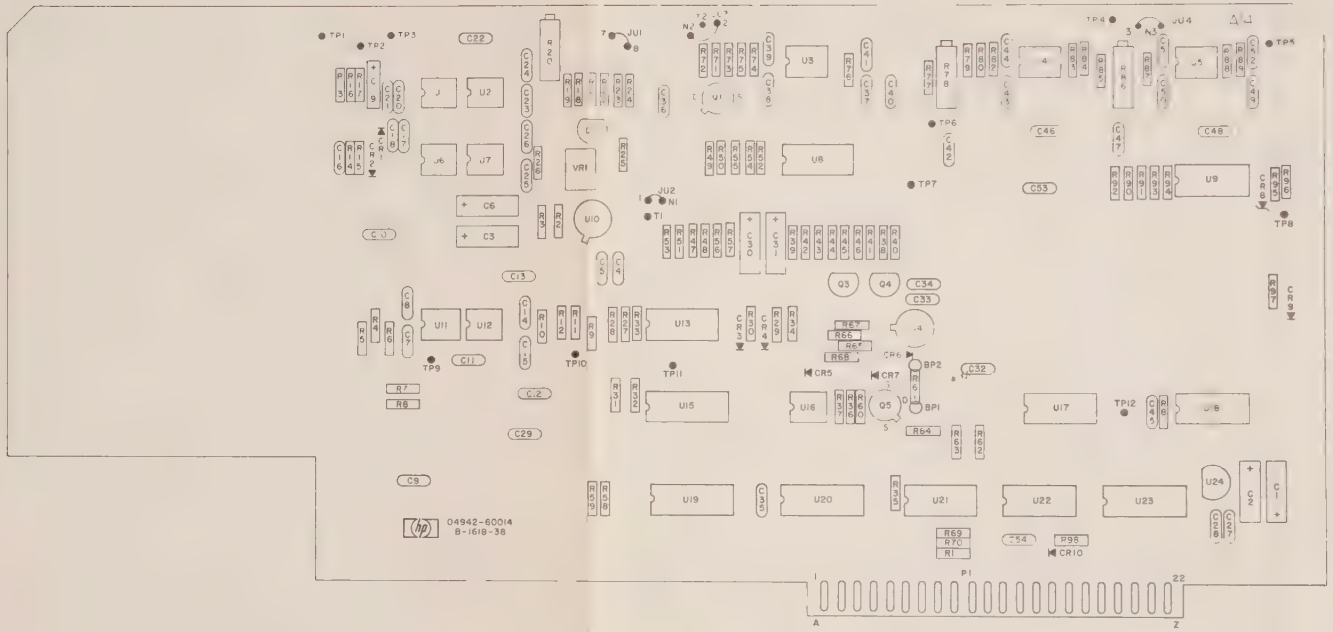
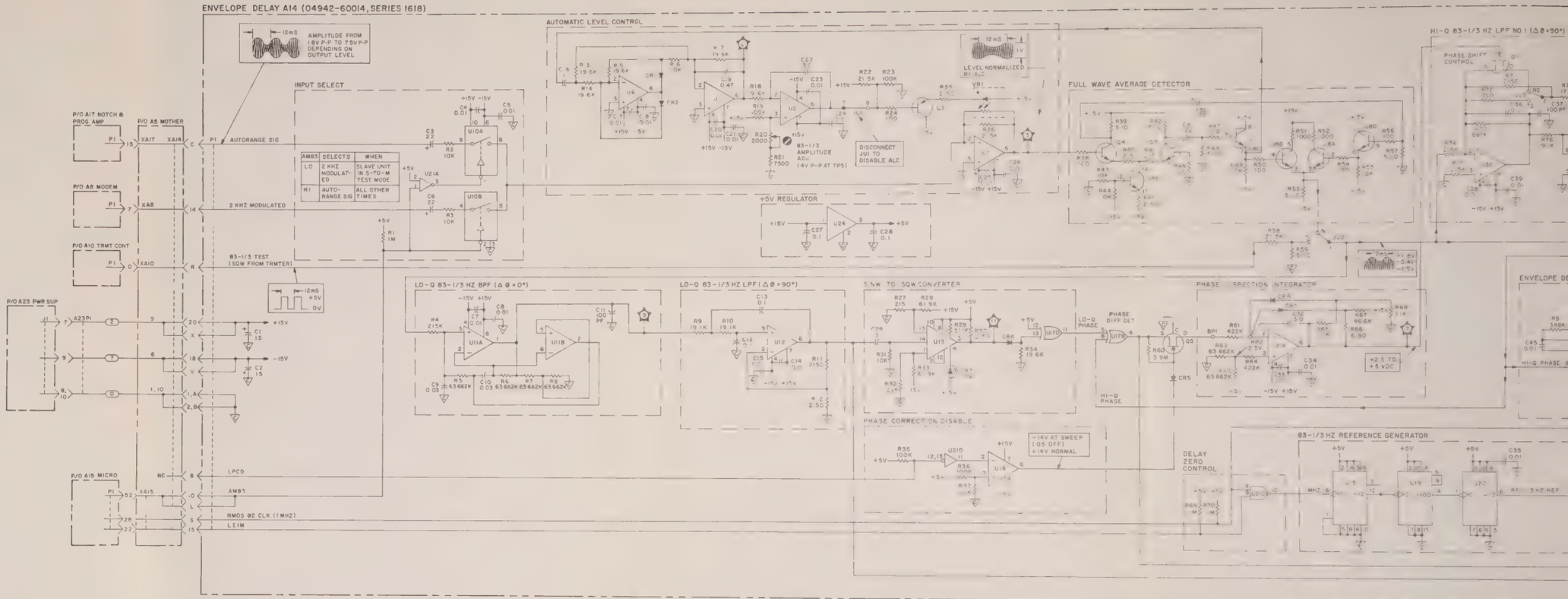


Figure 8-43. Envelope Delay A14 Component Locator


ENVELOPE DELAY A14 (04942-60014, SERIES 1618)
AMPLITUDE FROM 1 8V P-P TO 7 5V P-P DEPENDING ON OUTPUT LEVEL
INPUT SELECT
AUTOMATIC LEVEL CONTROL
LEVEL NORMALIZED (81-87)
FULL WAVE AVERAGE DETECTOR
HI-Q 83-1/3 HZ LPF NO 1 (Δ Ø = 90°)
PHASE SHIFT CONTROL
+5V REGULATOR
LO-Q 83-1/3 HZ BPF (Δ Ø = 0°)
LO-Q 83-1/3 HZ LPF (Δ Ø = 90°)
S/W TO SQW CONVERTER
PHASE CORRECTION INTEGRATOR
PHASE CORRECTION DISABLE
DISCONNECT JU1 TO DISABLE ALC
83-1/3 AMPLITUDE ADJ (4V P-P AT TP5)
+2.5 TO +5 VDC
LO-Q PHASE
HI-Q PHASE
PHASE DIFF DET
DELAY ZERO CONTROL
83-1/3 HZ REFERENCE GENERATOR
ENVELOPE DE
HI-Q PHASE
P/O A17 NOTCH & PROG AMP
P/O A5 MOTHER
P/O A8 MODEM
P/O A10 TRMT CONT
P/O A23 PWR SUP
P/O A15 MICRO
AUTORANGE SIG
2 KHZ MODULATED
83-1/3 TEST (SQW FROM TRMTER)
LPCO
AM83
NMOS Ø2 CLK (1 MHZ)
LL1M
+15V
-15V
+5V
AM83 | SELECTS | WHEN
LO | 2 KHZ MODULATED | SLAVE UNIT IN S-TO-M TEST MODE
HI | AUTO-RANGE SIG | ALL OTHER TIMES
-14V AT SWEEP (Q5 OFF) +14V NORMAL

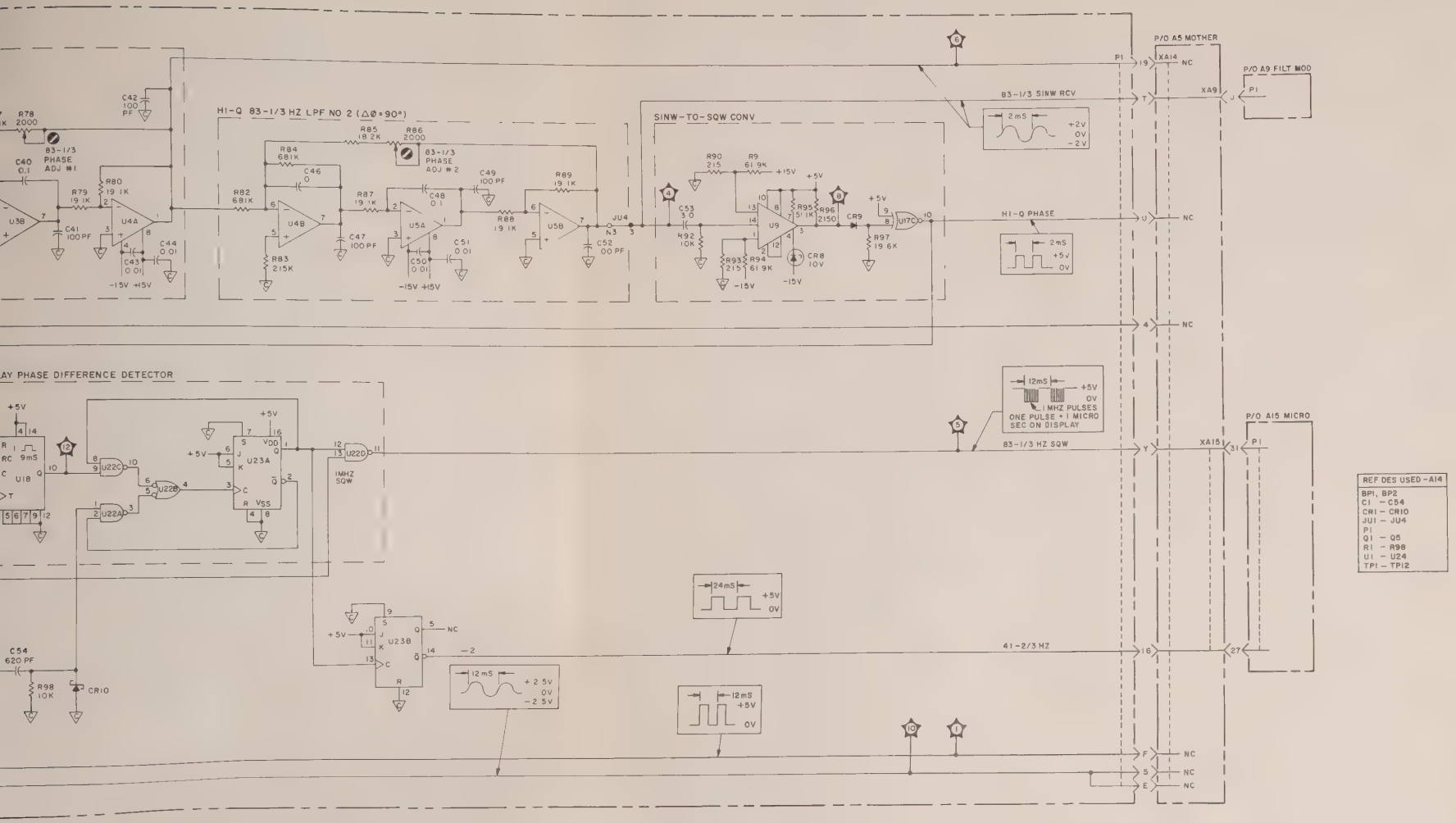


Figure 8-44. Envelope Delay A14 Schematic Diagram

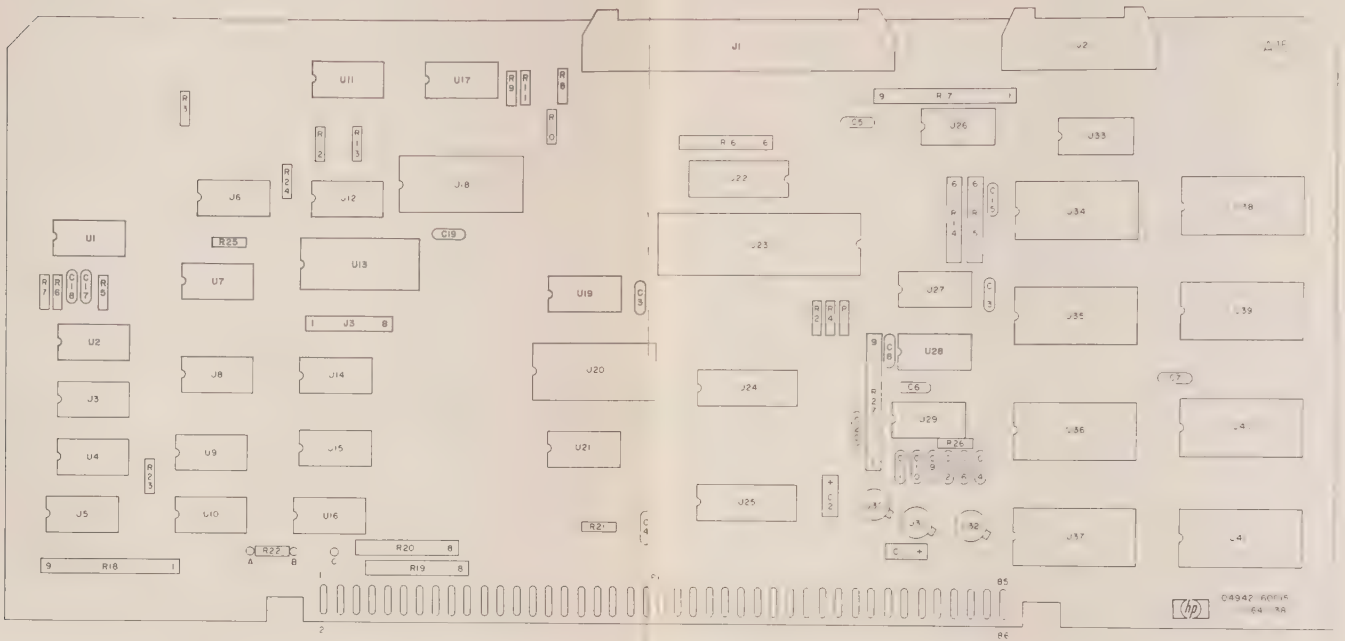


Figure 8-45. Microprocessor A15 Component Locator

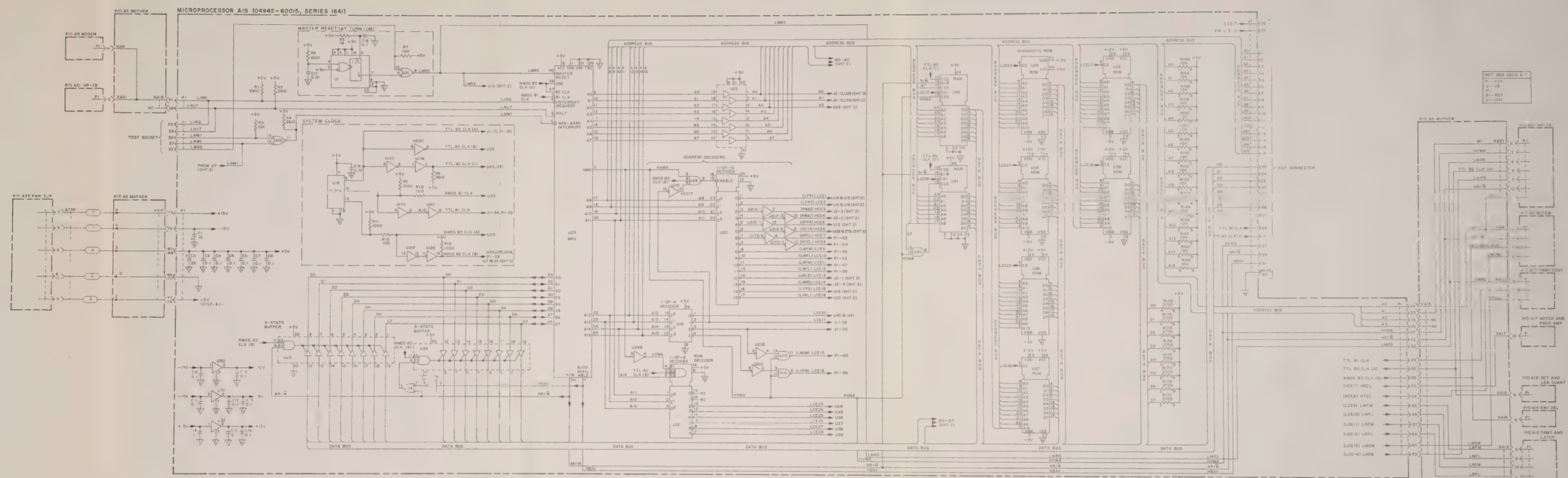


Figure 8-46. Microprocessor A15 Schematic Diagram (1 of 2)

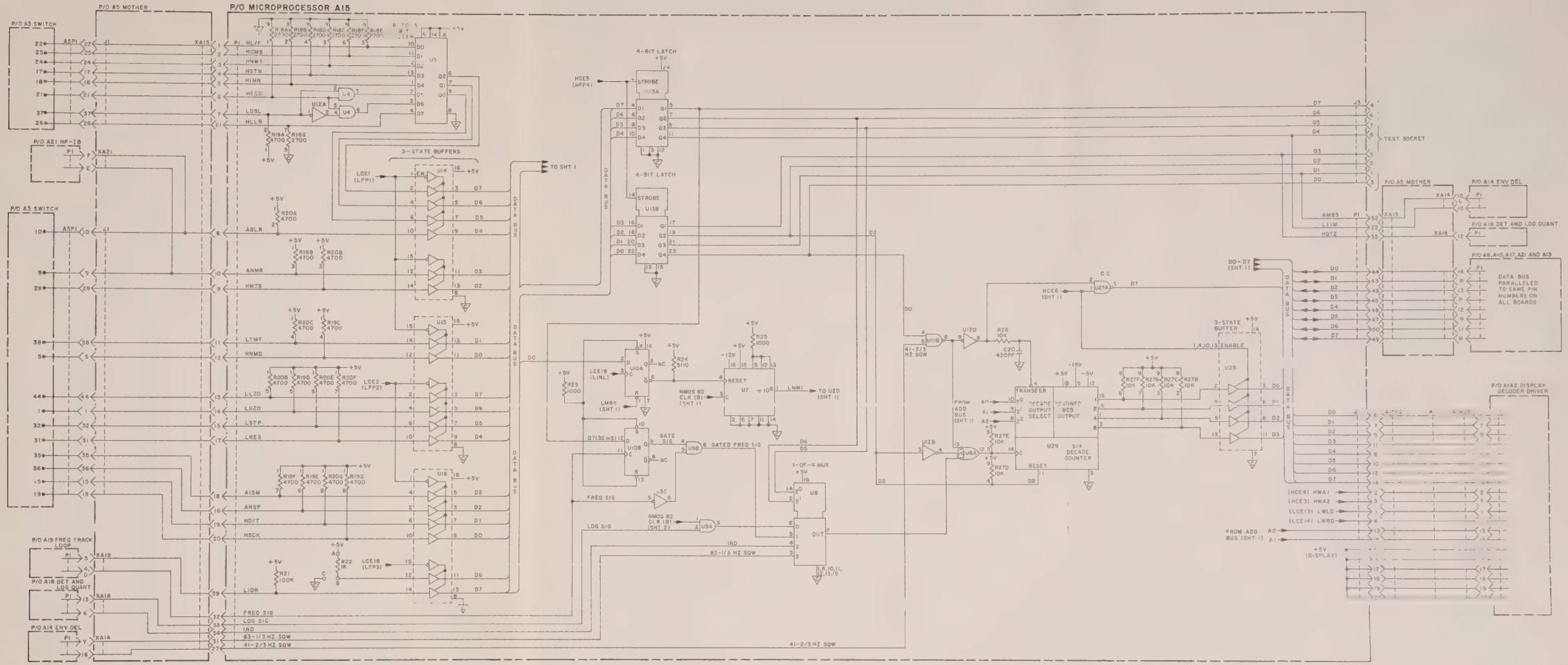


Figure 8-47. Microprocessor A15 Schematic Diagram (2 of 2)

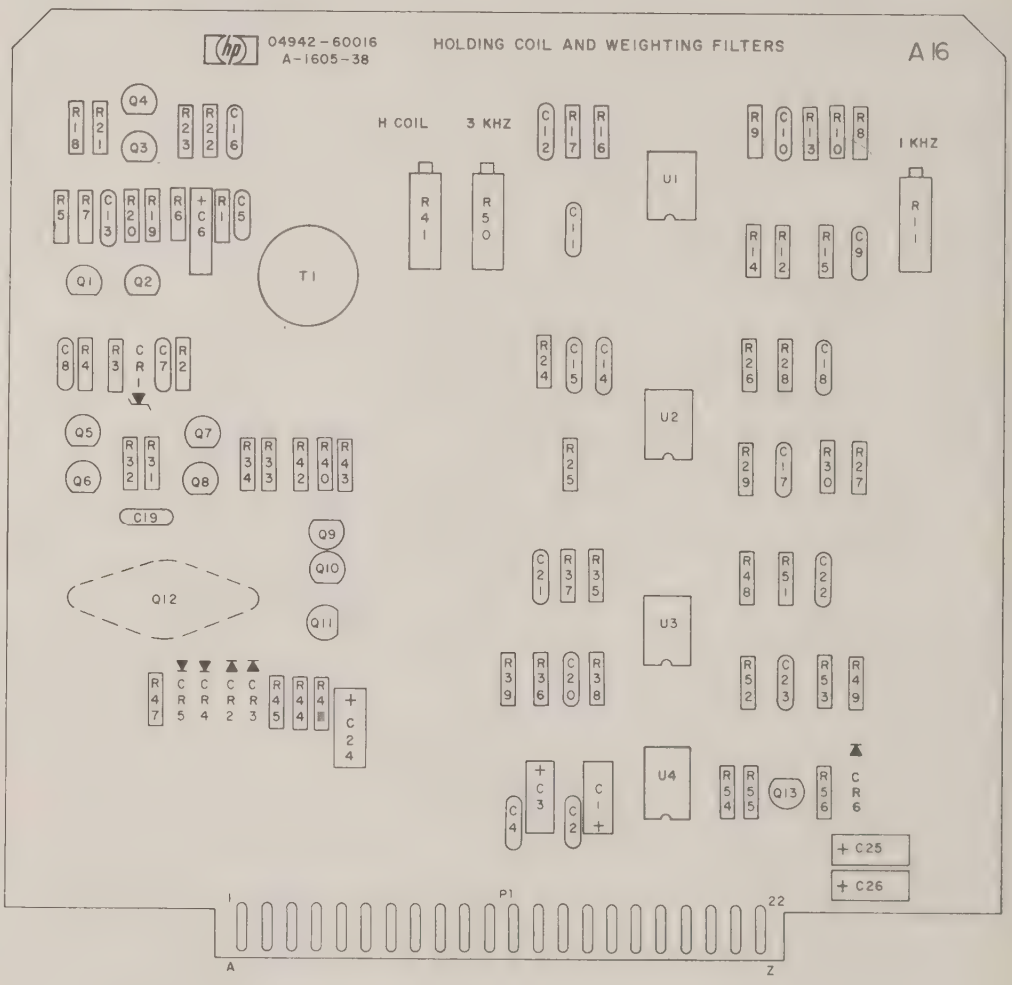


Figure 8-48. Holding Coil and Weighting Filters A16 Component Locator

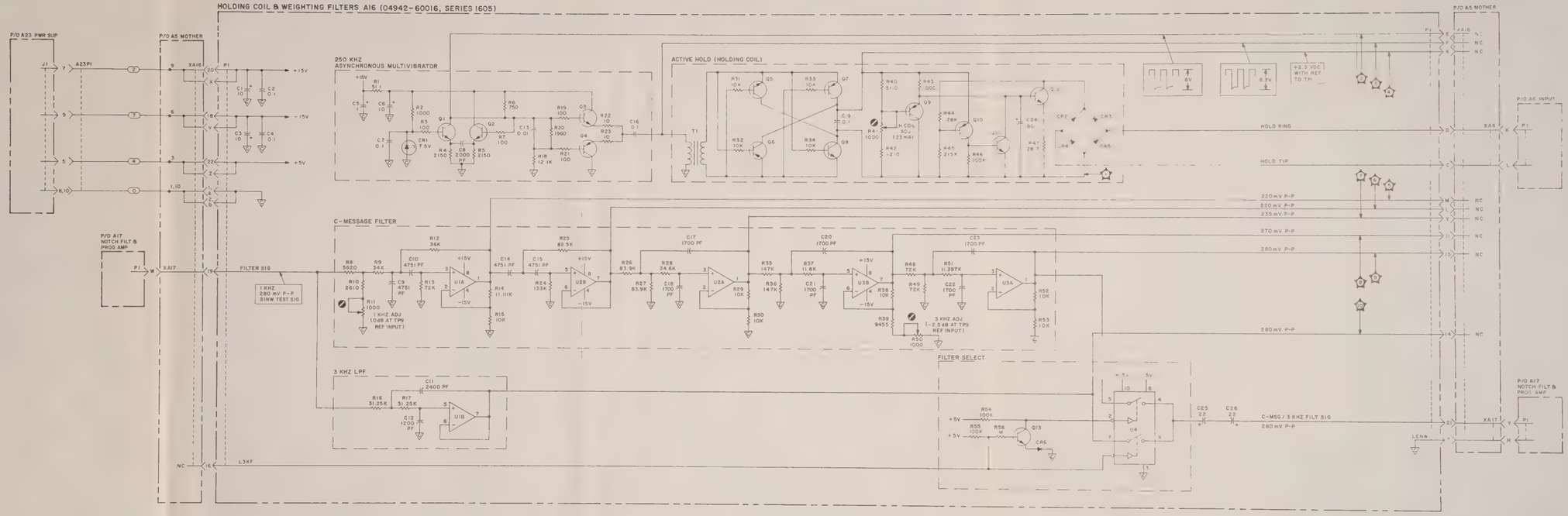


Figure 8-49. Holding Coil and Weighting Filters A16 Schematic Diagram

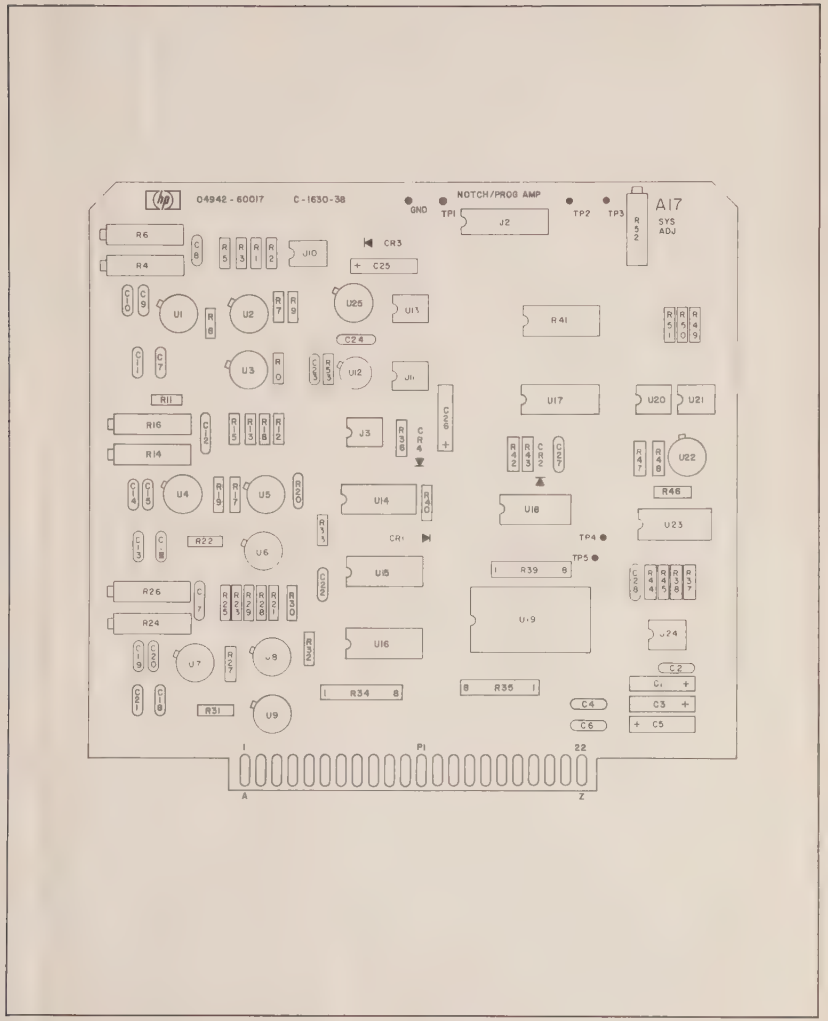


Figure 8-50. Notch Filter and Programmable Amplifier A17 Component Locator

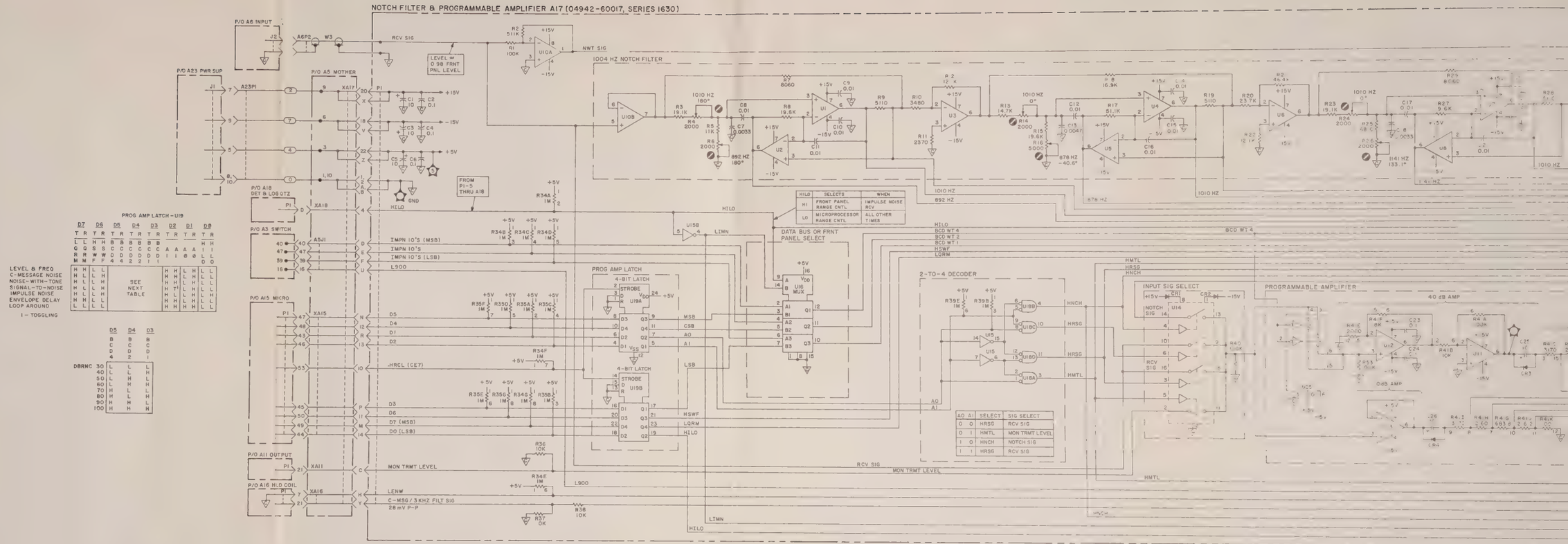
Table 8-3. A17 Troubleshooting Hints

1. To obtain manual control of the Programmable Amplifier, remove A18 PC Bd assembly from the instrument. This breaks the HILO loop through A18 and allows the line to be pulled HI on A17. Control of the Programmable Amplifier is then given to the front panel IMPULSE NOISE thumbwheel switch (TENS switch). The following test results can then be expected.

With U14 output (at pins 9, 11, 13, and 15) of 200 mV p-p at 1000 Hz.

A2S1A POSITION	BCD WT 4	BCD WT 2	BCD WT 1	AMPLITUDE AT TP2
100	HI	HI	HI	3.2 mV p-p
90	HI	HI	LO	10 mV p-p
80	HI	LO	HI	32 mV p-p
70	HI	LO	LO	100 mV p-p
60	LO	HI	HI	320 mV p-p
50	LO	HI	LO	1V p-p
40	LO	LO	HI	3.2V p-p
30	LO	LO	LO	10V p-p

2. To force the Programmable Amplifier output to be selected by the multiplexer U23, remove A16 PC Bd assembly. This removes the ground from the LENW line and allows the line to be pulled HI. This causes the NOISE FILTER SIG SELECT circuit to select the PROG. AMP. signal direct, rather than through the noise filters.


NOTCH FILTER & PROGRAMMABLE AMPLIFIER A17 (04942-60017, SERIES 1630)
P/O A6 INPUT
J2
A6P2
W3
RCV SIG
LEVEL = 0.98 FRNT PNL LEVEL
NWT SIG
P/O A23 PWR SUP
J1
A23P1
P/O A5 MOTHER
XA17
1004 HZ NOTCH FILTER
1010 HZ 180°
892 HZ 180°
1010 HZ 0°
878 HZ -40.6°
1141 HZ 133.1°
HILO
LTMN
FROM P1-5 THRU A18
P/O A18 DET & LOG QTZ
XA18
P/O A3 SWITCH
A5J1
IMPN 10'S (MSB)
IMPN 10'S
IMPN 10'S (LSB)
L900
PROG AMP LATCH - U19
D7 D6 D5 D4 D3 D2 D1 D0
LEVEL & FREQ
C-MESSAGE NOISE
NOISE-WITH-TONE
SIGNAL-TO-NOISE
IMPULSE NOISE
ENVELOPE DELAY
LOOP AROUND
I - TOGGLING
SEE NEXT TABLE
D5 D4 D3
DBRNC 30 40 50 60 70 80 90 100
PROG AMP LATCH
4-BIT LATCH
STROBE
U19A
U19B
MSB
CSB
AO
A1
LSB
HSWF
LQRM
HILO
P/O A15 MICRO
XA15
D5
D4
D1
D2
-HRCL (CE7)
D3
D6
D7 (MSB)
D0 (LSB)
P/O A11 OUTPUT
XA11
MON TRMT LEVEL
P/O A16 HI-D COIL
XA16
LENW
C-MSG/3KHZ FILT SIG
28 mV P-P
DATA BUS OR FRNT PANEL SELECT
U16 MUX
HILO SELECTS WHEN
HI FRONT PANEL RANGE CNTL IMPULSE NOISE RCV
LO MICROPROCESSOR RANGE CNTL ALL OTHER TIMES
2-TO-4 DECODER
BCD WT 4
BCD WT 2
BCD WT 1
HSWF
LQRM
HMTL
HRSG
HNCH
AO A1 SELECT SIG SELECT
0 0 HRSG RCV SIG
0 1 HMTL MON TRMT LEVEL
1 0 HNCH NOTCH SIG
1 1 HRSG RCV SIG
INPUT SIG SELECT
NOTCH SIG
RCV SIG
PROGRAMMABLE AMPLIFIER
40 dB AMP
0dB AMP

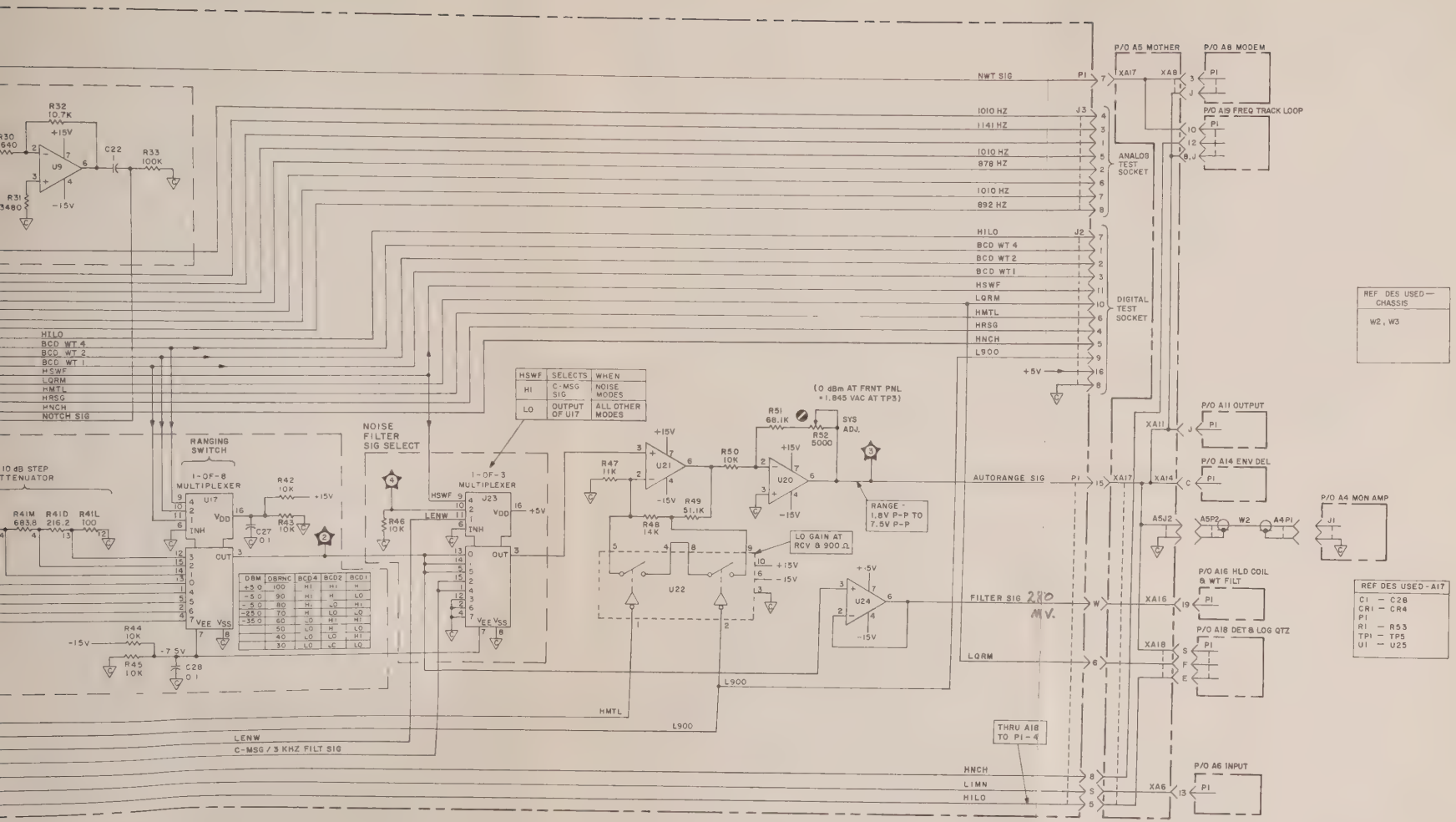


Figure 8-51. Notch Filter and Programmable Amplifier A17 Schematic Diagram

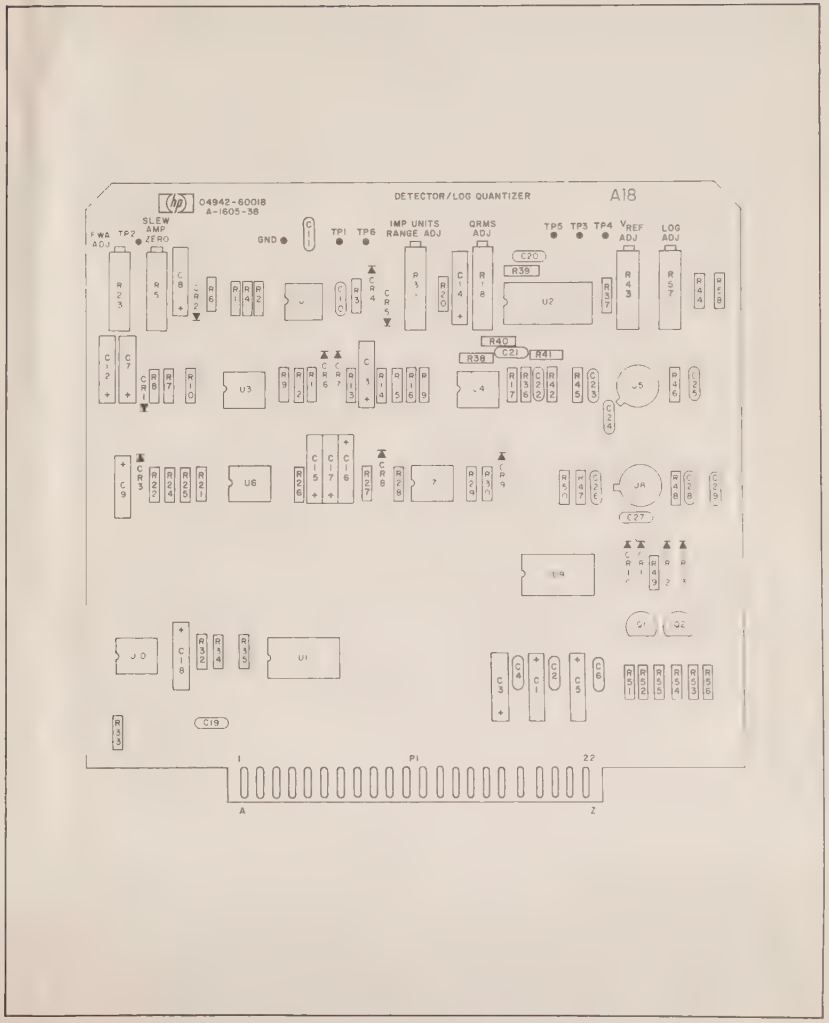


Figure 8-52. Detectors and Log Quantizer A18 Component Locator

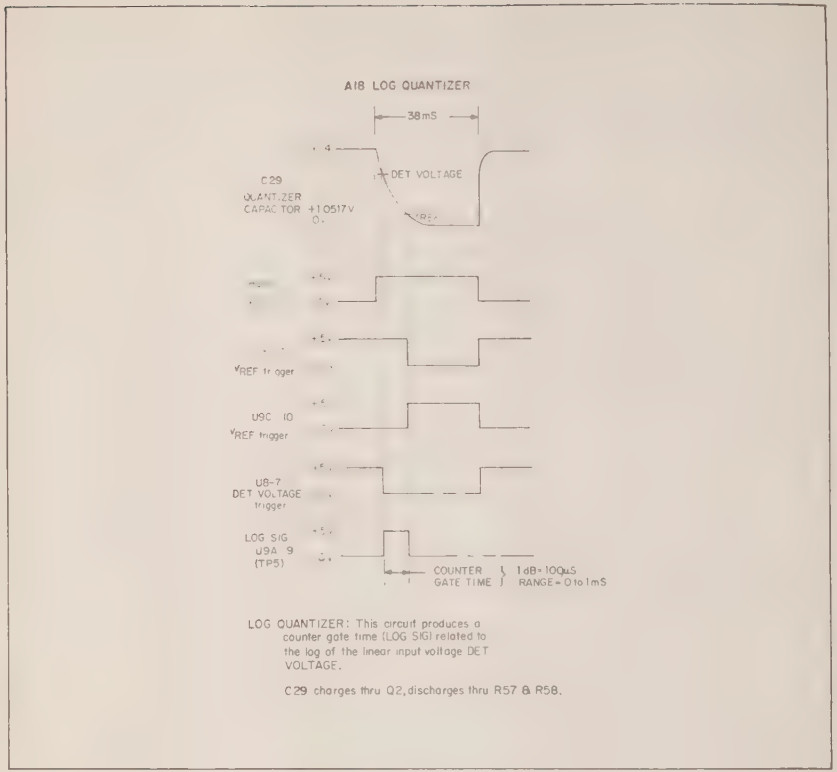


Figure 8-53. Log Quantizer Waveforms

*A18R35 FACTORY SELECTED COMPONENT

The procedure for selecting this resistor is given in the Adjustments section of this manual. See the Impulse Noise Count-Rate Adjustment.

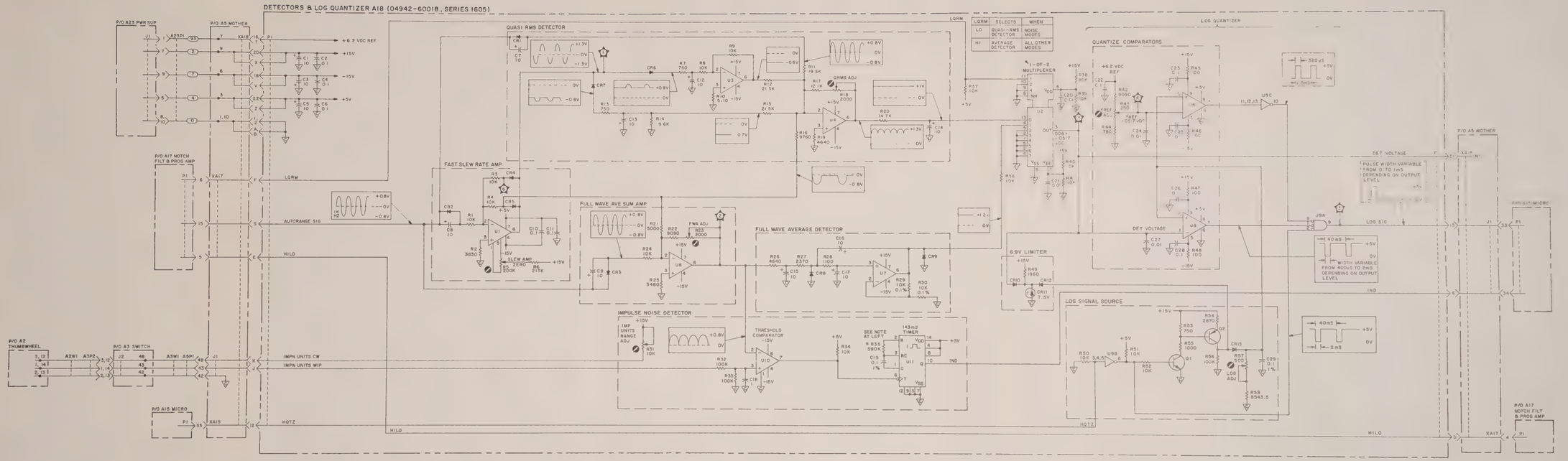


Figure 8-54. Detectors and Log Quantizer A18 Schematic Diagram

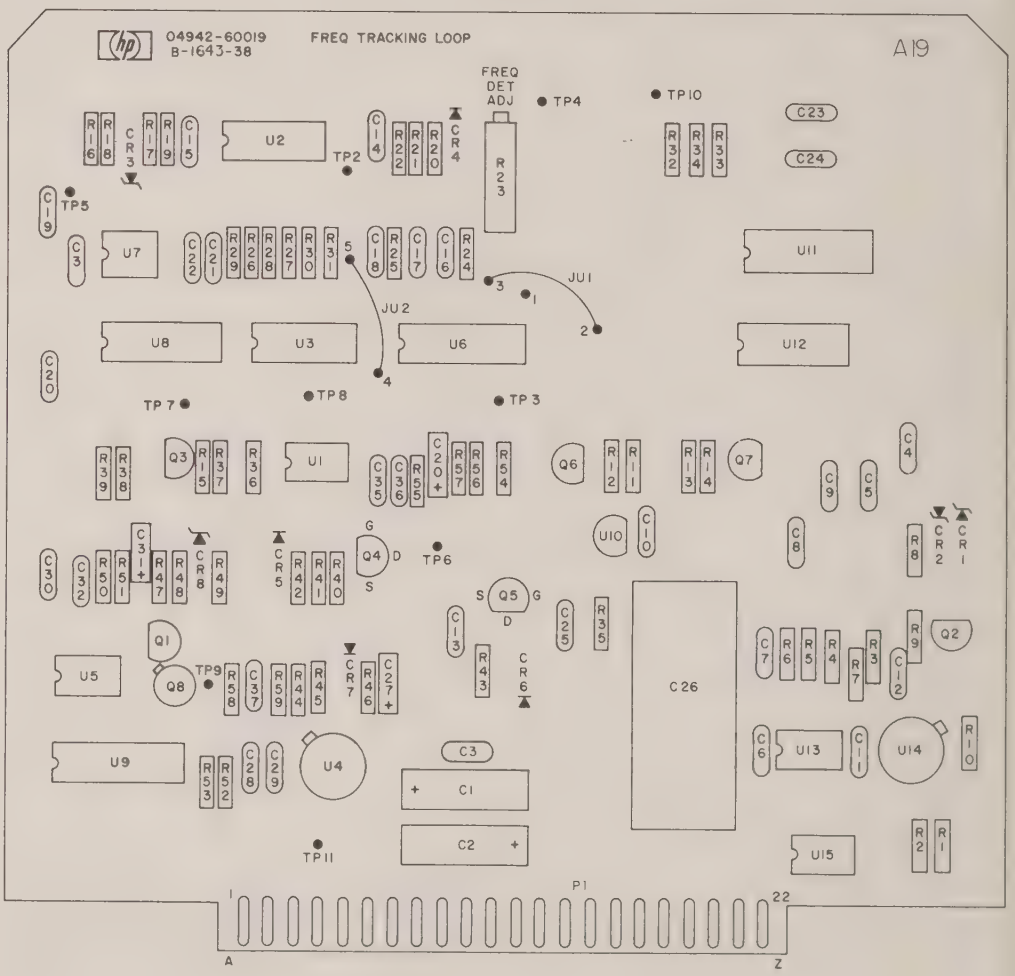


Figure 8-55. Frequency Tracking Loop A19 Component Locator

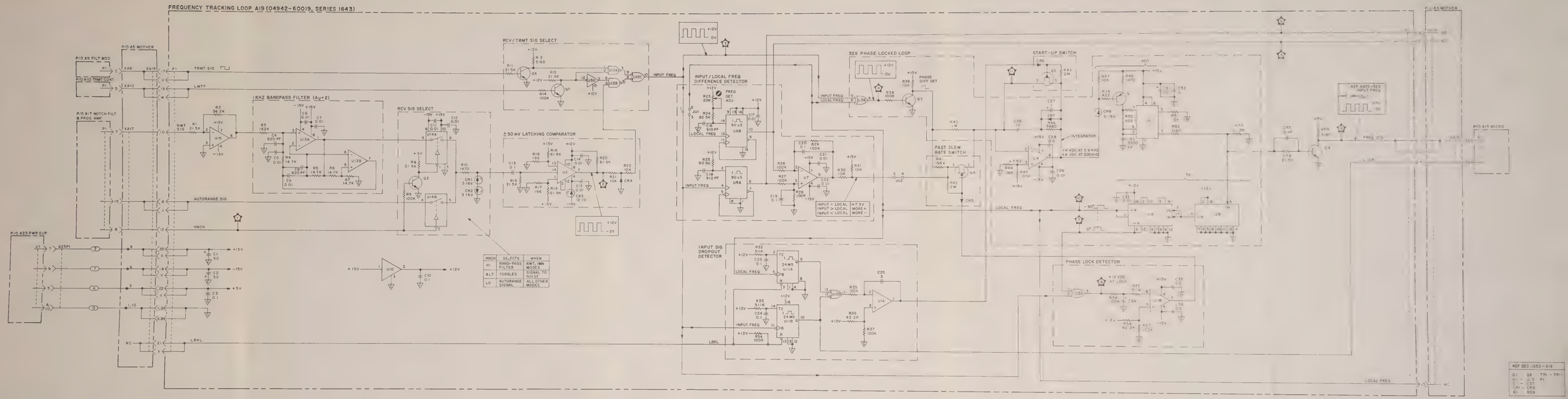


Figure 8-56. Frequency Tracking Loop A19 Schematic Diagram

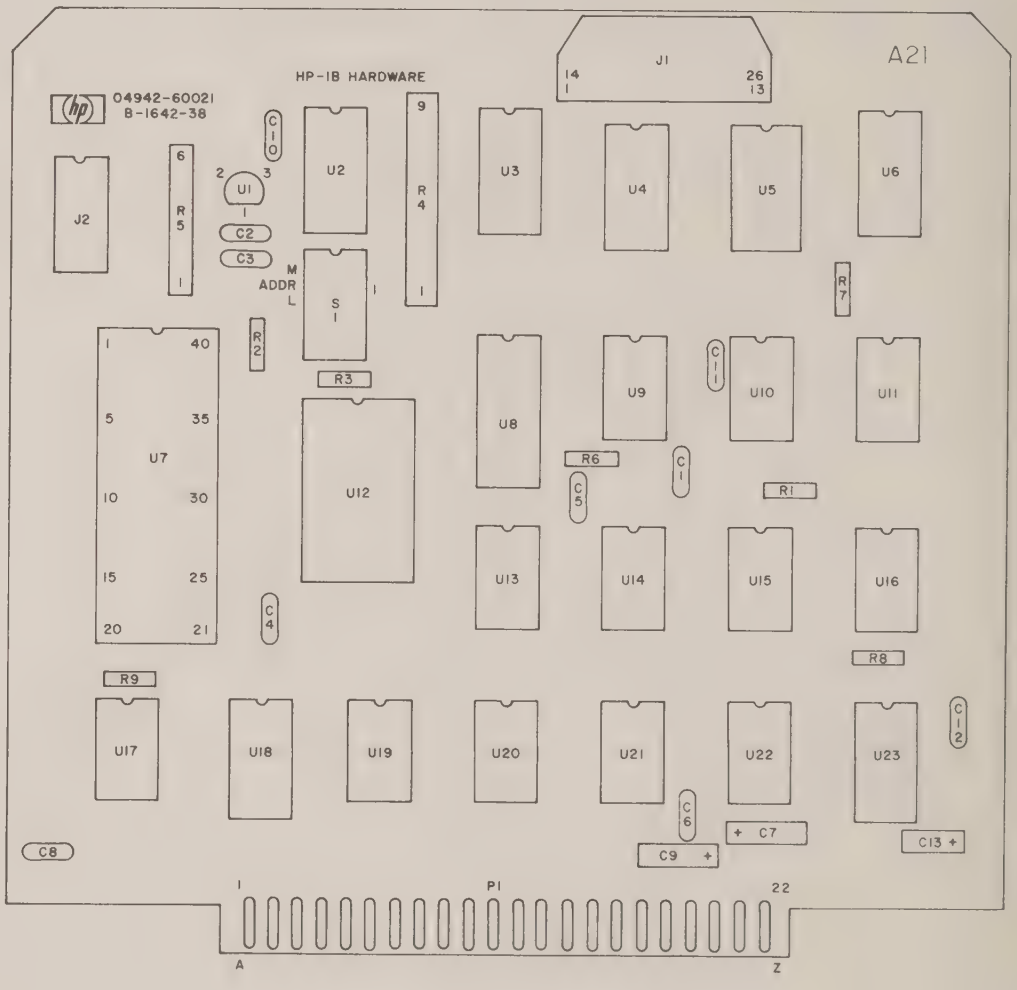


Figure 8-57. HP-IB A21 Component Locator

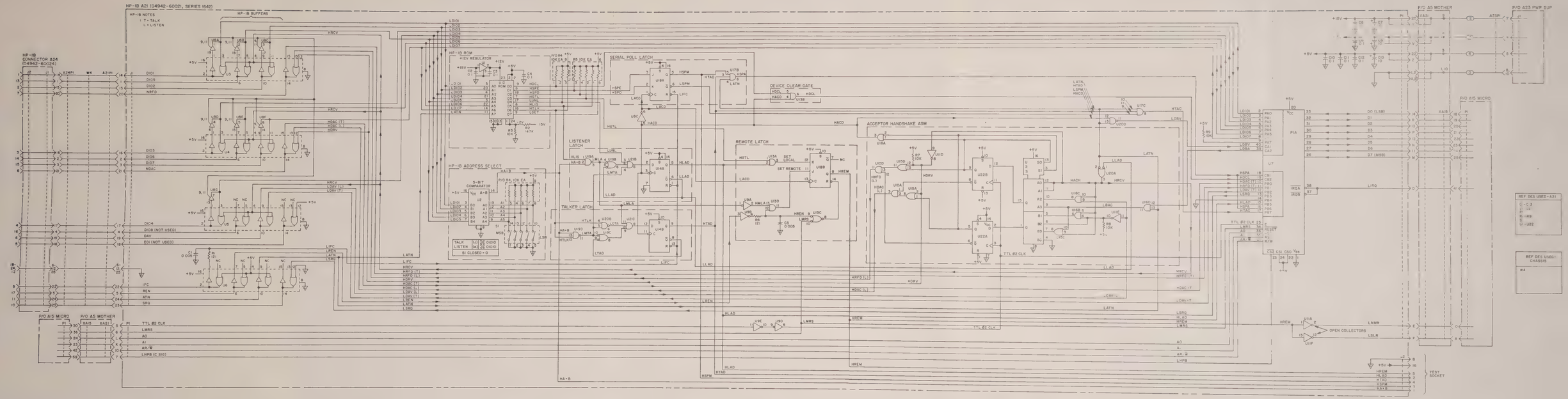


Figure 8-58. HP-IB A21 and HP-IB Connector A24 Schematic Diagram

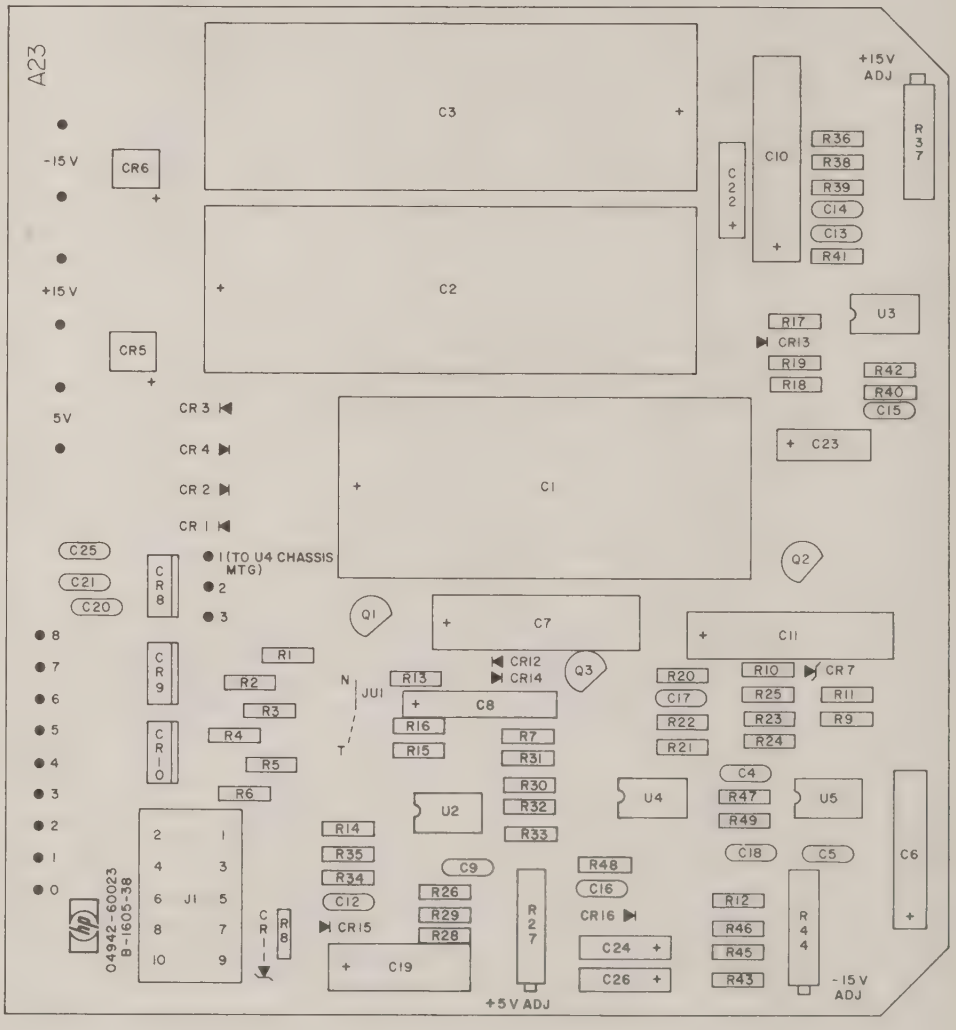


Figure 8-59. Power Supply A23 Component Locator

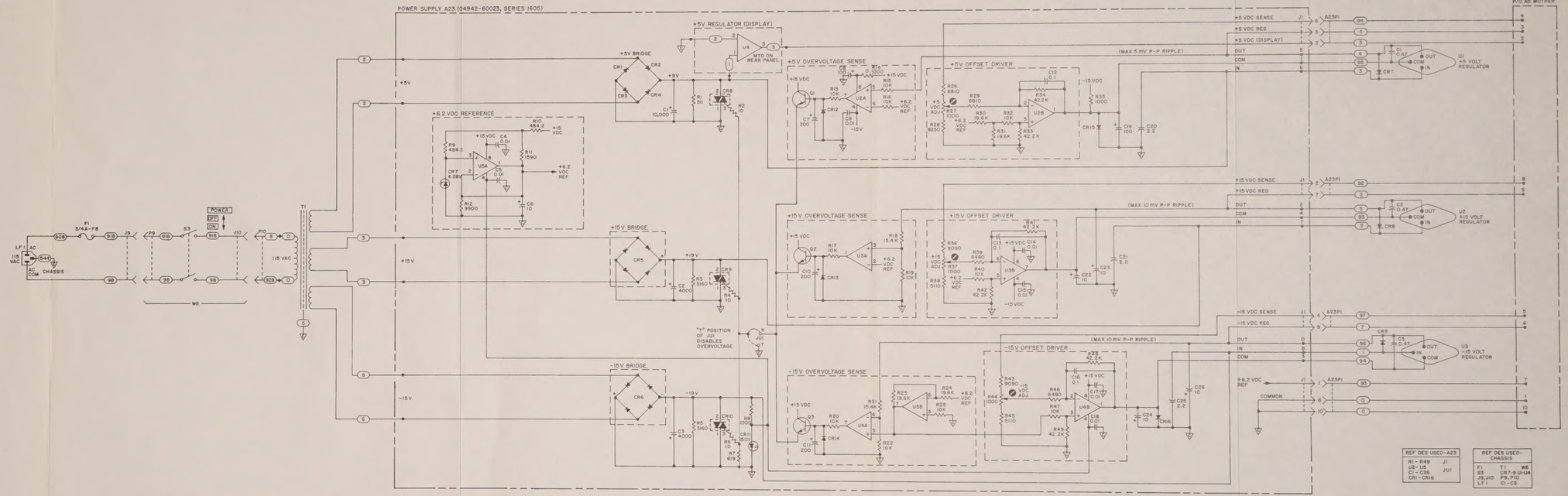


Figure 8-60. Power Supply A23 Schematic Diagram

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